

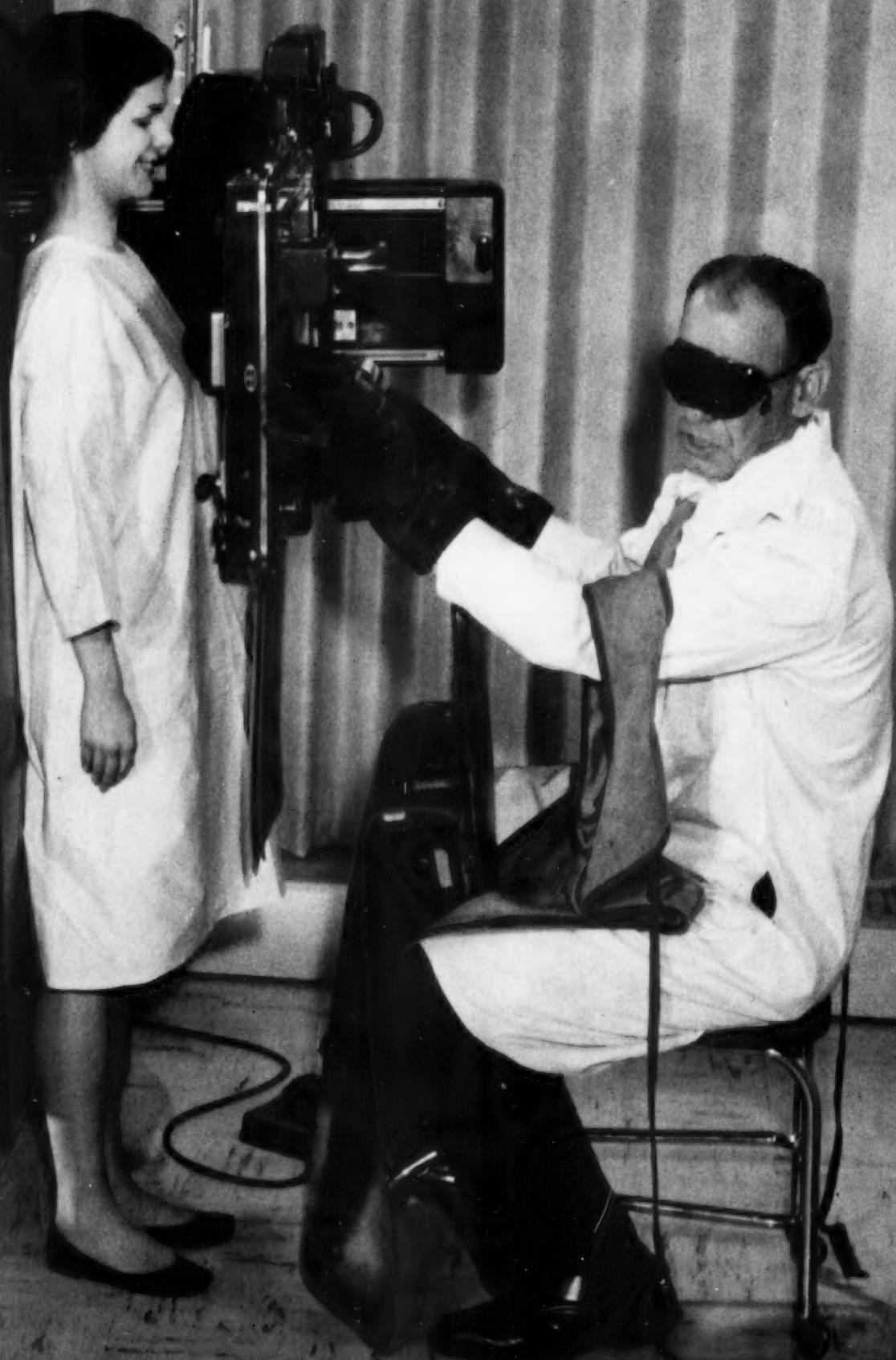
PUBLIC HEALTH REPORTS

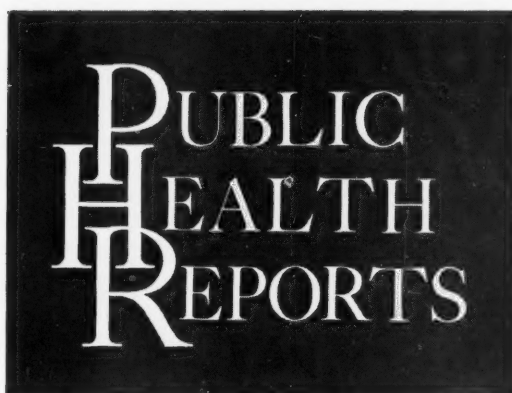
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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

X-RAY





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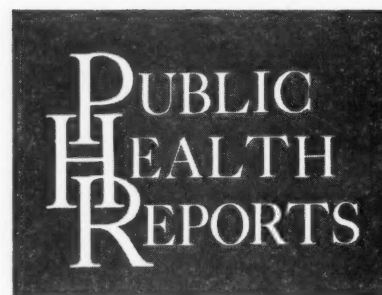
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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New Horizon in Mass Inoculation

RICHARD L. TOWLE, M.A.

MASS immunization programs are beset with many difficulties, not least of which is the time-consuming operation associated directly with inoculation of the vaccinee. Several years ago, U.S. Army scientists applied the jet injection principle (1) in the development of an automatic multiple-dose syringe (2) for immunizing large groups of people. This instrument, with some improvements, has been employed on a limited scale by the Armed Forces with encouraging results. The time required to vaccinate groups of men was much less when the jet injector was used than when the ordinary syringe and needle method was followed. Moreover, experience indicated that the immunological responses elicited by several types of vaccine administered by jet injection were comparable to those obtained by the usual methods (3-5).

It remained to be determined whether the procedure which seemed practical for large-scale immunization of military personnel might be equally useful for civilian groups. The present report describes the results obtained in mass immunization programs in Pakistan in which cholera and typhoid vaccines were administered to the civilian population by means of a Hypospray Multidose Jet Injector (4). This instrument is compact, fitting into a container the size of an overnight suitcase. Vaccine is forced through a minute aperture under sufficiently high pressure so that the jetstream penetrates the skin and enters the subcutaneous tissue. The vaccine,

in its course from the reservoir bottle to the aperture, remains in a closed, sterile system. Pressure for injection is applied to a plunger by release of powerful springs. Power for cocking the springs is obtained from a hydraulic system activated by an electric motor. The entire process of loading the discharge chamber with vaccine, cocking the drive springs, and inoculating the immunogen into the patient requires only a few seconds.

East Pakistan is one of the few remaining endemic areas of cholera in the world; the Province usually suffers over 15,000 attacks and 10,000 deaths yearly (6). It is probable that, owing to inadequate reporting of infectious diseases, these figures are not entirely reliable.

But it is known that cholera reaches two peaks during the year, the first in May prior to the onset of the summer monsoon rains and the second starting in September at the end of the monsoon and continuing through the months of October, November, and December.

Immunizations in East Pakistan, except during emergencies such as the 1958 smallpox epidemic, are carried on by the limited staff of the Directorate of Health Services. The population of East Pakistan is approximately 46 million people. There are about 400 sanitary inspectors, or about 1 per 100,000, each supervising 2 to 3 health assistants who are responsible, among other duties, for the complete immunization of the people. This means only 1 vaccinator and inoculator for approximately every 40,000 persons.

Immunization teams are handicapped by travel conditions. There are comparatively few roads, rail service is limited, and air service within each Province is almost nonexistent.

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These limitations, coupled with the fact that most of the land is under water for several months during the monsoon, severely hamper the mobility of the health workers. Within each thana, a political unit of roughly 100,000 population, nearly all local movement is confined to foot or small country boats.

The psychological aspect of the use of the syringe and needle, itself is another obstacle to immunization. In any population of any country, many people actually shrink from not only the sight but the idea of the needle. This is especially true in East Pakistan where so many are comparatively uneducated villagers. In many areas they do not understand the nature of disease or preventive measures. Not understanding, they feel no stimulus to overcome the apprehension against the needle the way people might in other societies. The purdah system among the Moslem peoples further complicates matters by making it extremely difficult to reach the female element of the population.

Even the educated classes have misgivings about immunization because the majority of injections have been given with an unsterilized syringe and needle, with the risk of transmitting malaria, syphilis, or hepatitis, which are common in this part of the world.

Taking these conditions into consideration, the task remained to prove the utility of the machine in different areas and in various situations.

Initially, demonstrations of the machine were given to different groups. This was done to familiarize community leaders with the jet injector and to determine the reaction of the people toward this new method of inoculation. Demonstrations were given to doctors, medical students, civic groups, health workers, the military, students, and various women's groups in Dacca and throughout the Province. In all instances the reaction was highly favorable. The fact that no needle was used seemed to impress the people more than any other factor. Also encouraging were the numerous comments regarding the relative absence of pain and the speed of inoculation.

Although the general response to these numerous demonstrations was completely positive, the majority of these people were of the educated classes. It remained to be seen whether the re-

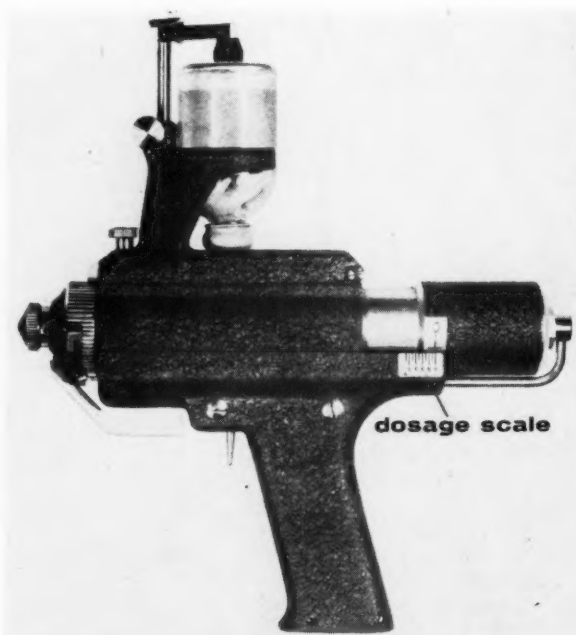
action would be as favorable among the less educated groups, to which most of the population of East Pakistan belong. These were the people exposed to disease, the ones who would determine the effect of immunization efforts.

During the following months, accompanied by a Pakistani team usually comprising a doctor and two sanitary inspectors, I took the injector into many areas of the Province, inoculating for cholera. We inoculated people in areas easily accessible, in some almost completely inaccessible, and in cities, small towns, and market areas. We tried to select places which would give us a cross section of East Pakistan.

Inoculations in Urban Areas

In mass inoculation in city areas, it is thought that the machine proved itself without doubt. In most instances, inoculations were done from a station wagon equipped with a generator which provided electricity for the injectors and a microphone and speaker for publicity. There was no problem in attracting crowds; a constant line waited for inoculation.

An excellent example of the capability of the machines was shown in Dacca during the October-November mass inoculation program



Hypospray Multidose Jet Injector



against cholera. Thousands were inoculated daily, with two injectors in operation. The highest figure for 1 day totaled 6,759. Sanitary inspectors and doctors, working with syringe and needle during the campaign, were reporting about 100 inoculations per inoculator per day. It was clearly indicated that one injector could do the work of 25 to 30 men.

The only experience of inoculating with the injectors outside of East Pakistan was in the first week of July in Karachi, West Pakistan. Owing to excessive rainfall in June, much of Karachi was flooded. Nearly all of the refugee colony areas were under water, and there arose considerable danger of a typhoid epidemic. Thirty centers were set up throughout the stricken area for inoculation against typhoid fever, paratyphoid fever, and cholera. The injectors were brought from East Pakistan to aid in the fight. In 4½ days, with only one machine operating, approximately 20,000 persons

were inoculated. The entire staff of the 30 centers, inoculating by syringe and needle, were only able to inoculate about the same number during the same period.

As the work in a municipal area is carried on most successfully as an outdoor operation, most of the persons inoculated were men and children. Few women were reached in this situation because of the purdah system and the social restrictions on women moving about in public. To overcome this difficulty, we set up special centers in buildings for women only. Attendance depended greatly on selection of the site, time of inoculation, and adequate publicity.

The experience of inoculating in urban areas was highly encouraging. With adequate planning, there is no doubt that jet injection can be successful in treating most of a population's men, women, and children in a minimum of time, whether in an emergency situation or in routine preventive programs.

The hats, or market areas, of Bengal also provide excellent opportunity to reach the maximum number in the minimum period. These weekly markets attract gatherings ranging from a few hundred to as many as 20,000 people, according to their size, location, and importance. In a central location in the hat, even without publicity, it has been comparatively easy to inoculate 500 persons an hour with one machine.

The larger markets, such as the Ghior Hat located in Manikganj Subdivision, Dacca District, provide an excellent opportunity to reach many of the people who would be otherwise comparatively inaccessible and also at the highest risk. People come 40 or 50 miles to a hat to sell or exchange produce and animals. Many come by river boats, which constitute the major mode of transportation in the delta area. As most of these river people live on their boats and are constantly moving, it is practically impossible to reach them at any other time. The river satisfies practically all their needs for drinking, washing, and cooking water. All of the rivers are congested with these riparian rambles.

People living on or near the rivers, and their animals, use them for all purposes. Latrines overhanging the banks are a common sight. There is a chronic threat of infection therefore to the people living on or near the waterways.

Even though most of the people at the hats

are men and children, it is felt that, by the inoculation of this great mass of transients, it may be possible to break one of the more important links in the chain of disease, by means of the jet injector, the one instrument by which it is possible to inoculate enough of these persons quickly. The duration of these hats is only 1 day per week. If the people are not reached on that day, they may carry infection throughout the Province.

Inoculations in Rural Areas

While there remains little doubt that the injectors can be used successfully in places, such as municipal areas and markets, where a great number of people congregate, the principal question concerns their utility in rural areas. In East Pakistan approximately 90 percent of the population of 46 million live in villages. It is estimated that of this 90 percent, at least 40 percent are using water supplies that are considered unsafe. These therefore are the population at greatest risk.

With this factor in mind we set up experimental mass inoculation campaigns in rural areas in different places throughout the Province.

Some of these were easily accessible by road, some by river in either launches or country boats, and some only by foot. All proved of value and brought many facts to light which will prove of value in future mass inoculation.

Mass cholera inoculation, Debidwar Union, Debidwar Thana, Tippera District, East Pakistan

Village	Population	Inoculations					Inoculation time (hours)	Approximate travel time (hours)
		Men	Women	Children	Total	Percent		
Bhoshna	520	104	115	159	378	73	2½	1¼
Champanagar	510	82	59	150	291	57	1	1
Chhota Alampur	660	57	35	85	177	27	1	¾
Debidwar	2,020	978	75	193	1,246	62	3	½
Binaypar	300	23	49	60	132	44	1	1
Noma Bara	300	43	41	73	157	52	1	1
Balibari	500	59	72	146	277	55	1	1
Bara Alampur	1,200	126	61	237	424	35	2	1
Kanibil and Biniapara	620	223	154	209	586	95	2	1½
Marichakandi	980	127	144	228	499	51	1½	1
Bhinglabari	1,000	58	97	166	321	32	1	¾
Fatehabad	1,200	172	218	349	739	62	2	1½
Shailchar	360	40	37	57	134	37	½	¾
Total	10,170	2,092	1,157	2,112	5,361	52.7	19½	13

One campaign typical of rural East Pakistan from the standpoint of type of area, concentration of population, and transportation facilities was in Debidwar Thana, Tippera District. This was an area of average-sized villages accessible only by foot. From this thana we selected one union, a political land unit of from 8,000 to 12,000 population, and inoculated on a village-to-village basis throughout the area. The villagers were informed of the expected time of our arrival by the chowkidars, village officials who serve as registrars, night guards, and tax collectors, and the arrangements and selection of sites were left in the hands of the village leaders. The table shows the results of this controlled experiment. As previously stated, this area was typical as to terrain and people, and the results obtained were about the same as in other areas throughout the Province.

Many conclusions are apparent from this table and many more from observation during the inoculation periods. The total time consumed in this operation was approximately 321½ hours, or about four average working days. As only one machine was used in the operation, the average rate of inoculation was 1,340 per day per machine. Inoculators who had previously worked in this area reported the maximum number that could be done by one man with syringe and needle would be 100. So, despite the fact that these figures are small compared with those of urban areas, the injector was still doing the work of 13 men.

Discussion

The data clearly indicate a great variation in the percentages of persons inoculated in different villages, ranging from 27 percent to 95 percent. This could be traced to many different causes. In Chhota Alampur, Bara Alampur, and Shailchar, no previous notice had been given by the chowkidars. Because of this, many of the people were away from the village and working in the fields at the time of our arrival. In Bhinglabari, a village which is spread out over a wide area, it was raining hard during the time of inoculation and the villagers had great difficulty in reaching the site. Thus, in the four villages with the lowest percentages of inoculations, the poor showing could be traced to lack of notification,

which can be remedied, and to weather, an unavoidable factor.

The cooperation and interest of the village leaders was another element which greatly influenced the success of the program in each village. In the combined villages of Kanibil and Biniapara, the leader was an energetic person who so fully believed in the program that he went personally from house to house through both villages before our arrival and urged the people to come forward. His efforts were rewarded by the inoculation of 95 percent of the population of these two villages. The percentage of inoculation in the other villages seemed to vary proportionately with the interest and efforts of the leaders.

This again is a controllable factor. If these leaders can be called together before a program and fully educated as to the need for inoculation, the success of the campaign will be assured. As these leaders are usually older, highly respected persons, the people of their villages in most cases will follow their advice without serious question. Although total education of all the people in this respect would be the ideal, we can still accomplish our purpose by reaching this small influential group.

As the purdah system is more strictly observed in villages than in the cities, we were concerned whether the women would come forward to be inoculated. In view of this, the selection of the site of inoculation in the villages was of primary importance. We tried to select locations where the women would be protected from the eyes of men by a bamboo matting or screen as they approached to be inoculated. We found that, although they would not present themselves where men were gathered, they apparently had no objections to being seen by the person giving the inoculations, accepting him as a professional person. In most of the villages, there was no great difference in the numbers of men and women inoculated.

The one exception to this was in Debidwar, where the site selected by the officials was on the police station grounds in the center of a large open area. There was no way in which the women could approach with protection from the eyes of the many men gathered there.

Consequently few women came forward. This indicated that the site for inoculations must be selected with careful consideration of local customs.

We feel that the experiment was reasonably successful, since 52.7 percent of the population of the entire union were inoculated. We think, however, that the program could have been even more successful. Most of the factors that accounted for the low percentage of persons inoculated are remediable.

The experience at Debidwar is a fairly accurate picture of inoculations in rural areas. Some earlier campaigns were not so successful and a few later ones, through experience, were more successful. In these experimental mass inoculations extending over a period of 9 months, we have learned how to organize a program for the effective use of the jet injector in all sorts of difficult situations. We feel strongly, therefore, that these machines can be used effectively not only in fighting cholera here in East Pakistan but in the prevention of disease in any situation which calls for mass inoculation.

The utility of the injectors having been established, classes have recently been started training sanitary inspectors and doctors, not only in the operation of the machines but also in the complete repair and maintenance of them. It cannot be overemphasized that because of the intricate nature of the injector and inevitable breakdowns during field operations, the operator should not only be a competent inoculator but also a skilled technician.

Plans are presently underway to supply injectors in sufficient numbers to enable the men who are being trained to take over the major burden of mass inoculation in East Pakistan. When these plans have been realized, we will find a new horizon in the field of mass inoculation which may in time aid in the elimination of epidemics.

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EQUIPMENT REFERENCE

- (A) Hypodermic Multidose Jet Injector, R. P. Scherer Corp., Detroit, Mich.

Monthly ICRS Medical Reports

By arrangement with the Institute of Contemporary Russian Studies, Fordham University, the Russian Scientific Translation Program of the Public Health Service will distribute copies of the *ICRS Medical Reports* to persons and organizations currently on the program's mailing list. There will be no charge for these publications.

Hospitalization Experience of the Indigent in New Jersey

SAM SHAPIRO and VIRGINIA V. VAHEY

IN 1958, the New Jersey State Legislature authorized the establishment of a temporary commission to study and make recommendations on the administration of public medical care in the State. This action became necessary because of the problems that had arisen from the diversity and complexity of the many methods and agencies being used to provide medical care for public assistance recipients and other persons unable to meet the cost of medical care out of their own income and resources.

The financing of hospital care for these persons presents the most difficulties. Hospitals receive public funds in New Jersey for the care of public assistance patients and the medically indigent primarily through lump-sum appropriations of the many municipal or county governments. Under this system, payment is often not based on the amount of care given or on the per diem cost of providing care. As a result, the greatest problem the voluntary hospitals in New Jersey face, according to the representatives of the New Jersey Hospital Association, is the strain on the hospital's financial stability caused by care provided the indigent.

The alternative to the present complex system of appropriations and expenditures viewed favorably (and subsequently recommended) by the New Jersey Commission to Study the

Administration of Public Medical Care was the payment of hospitals "on a per diem basis, the costs of which are determined on the basis of a sound reimbursable cost formula." An essential element in considering costs under this type of payment was the hospitalization experience of the public assistance recipients and the medically indigent in the various counties of the State. A full picture of this experience, however, could not be obtained from existing records or reports. Admission records in many hospitals do not identify the individual's public assistance status or indicate whether he is medically indigent. In view of this situation, the commission, in cooperation with the New Jersey Hospital Association, conducted a survey to obtain the basic data needed to project costs (1).

General Hospitals in New Jersey

There are 152 hospitals in the State covering a wide range of functions and under varied types of governmental and nongovernmental control. The commission's interest was confined to the 86 short-stay general and maternity hospitals in the State; 82 are voluntary hospitals operated on a nonprofit basis, and the remaining 4 are city or county hospitals. In addition, there are nursing homes which take care of their residents' illnesses, specialty hospitals, Federal institutions, such as veterans hospitals, State hospitals, and public medical institutions which include medical sections of county or city infirmaries operated for chronically ill persons whose stay generally extends over long periods of time.

In 1958, there were about 610,000 admissions

Mr. Shapiro, director of the division of research and statistics, Health Insurance Plan of Greater New York, served as hospital study consultant, and Miss Vahey was project director for the New Jersey Commission to Study the Administration of Public Medical Care. Miss Vahey is now medical care administration specialist with the Division of Public Health Methods, Public Health Service.

to short-term hospitals in New Jersey. This represented an admission rate of 106 per 1,000 population in the State, lower than the national average of 125 per 1,000 persons (2). (New Jersey's rate may be comparatively low because some State residents enter hospitals in neighboring New York and Pennsylvania.) From the study, it appears that almost seven out of eight of the admissions are semiprivate and private; the rest are general service ward admissions. In many hospitals semiprivate and general service ward patients have similar facilities; the only difference between them is that the former have private physicians, and the latter receive free medical care from staff physicians while in the hospital.

Scope of Survey

In the survey special forms were mailed to short-term general hospitals in New Jersey with the request that a form be filled out for each person admitted as a general service ward case (a patient who did not have a private physician in attendance) during the 5-week period March 15–April 18, 1959. The pay status of the patient at time of admission was called for on the form for the purpose of distinguishing the following three categories of patients:

- Those paying in whole or in part for their bed care, either through hospital insurance or their own resources.
- Those receiving public assistance and the specific type of assistance program.
- Those considered medically indigent by the hospital and not in receipt of public assistance.

No attempt was made to define "medical indigency" since criteria for medical indigency were still to be established. A special inquiry to the hospitals revealed that the definition of medical indigency varied greatly from one hospital to another. A number of the hospitals base their decisions on detailed financial statements, others on the recommendation of the physician. Accordingly, statistics on the "medically indigent" developed through this survey refer to this category of patients as the hospitals defined it administratively early in 1959.

Also recorded on the survey form at time of admission were the patient's age, sex, and the

municipality where he was living. Later all forms were returned to the hospitals for dates of discharge and any change in pay status of the patient. It was anticipated that an appreciable number of the patients who were admitted as general service ward cases with the expectation of payment being made by them or by hospital insurance would become "free patients" before their discharge from the hospital. This did occur, but in the overwhelming majority of the cases their free pay status was retroactive to the date of admission.

Patients admitted as semiprivate or private cases and subsequently transferred to a general service ward were omitted from the survey. A telephone inquiry to six widely scattered hospitals showed that there were extremely few such patients and their exclusion would have little effect on any estimates of hospital usage by the medically indigent.

Sixty-two of the 86 short-stay hospitals in the State provided data for the study period. Four other hospitals stated they had no general service ward cases. The remaining 20 accounted for an estimated 5–6 percent of the total general service ward admissions in the State in 1958. No adjustments have been made for this percentage in the statistical results of the survey.

Results of the Survey

Hospital Admissions and Rates

The 5-week study conducted by the commission indicated that, during the course of the year, there are about 79,500 admissions of general service ward patients in New Jersey. Payment is made by Blue Cross and other insurance companies for 11,000, or 14 percent, of all general service ward cases. Another 27 percent are patients who pay all or part of their hospital bed care through their own resources or for whom payment is made by relatives. The remainder fall into one of two general categories, public assistance cases or medically indigent. The balance of this report is concerned with these two groups.

Based on the information obtained from the general hospitals, it is estimated that there are approximately 12,640 admissions of persons on public assistance in a year (table 1). About

Table 1. Annual numbers, rates, and duration of stay of general service ward admissions in New Jersey hospitals, public assistance recipients and the medically indigent

Pay status on admission	Number of admissions	Admissions per 1,000 persons receiving assistance	Average duration of stay (days)	Total days in hospital	Days per person receiving assistance
Public assistance.....	12,640	122	11.7	148,460	1.4
Categorical assistance.....	5,600	92	12.4	69,240	1.1
Old age assistance.....	2,240	¹ 117	18.6	41,670	2.2
Disability assistance.....	770	129	12.8	9,880	1.7
Aid to dependent children.....	2,530	73	6.8	17,110	.5
Aid to blind.....	60	(²)	(²)	580	(²)
General assistance.....	7,040	164	11.3	79,220	1.8
Crippled children and rehabilitation.....	340	(³)	16.8	5,710	(³)
Medically indigent.....	32,080	-----	11.0	352,490	-----

¹ Exclusion of persons on OAA rolls who are in nursing homes and public medical institutions from the total number of OAA recipients raises the hospitalization rate to 142 per 1,000.

² Not computed, too few cases in 5 weeks' sample.

³ Enrollment data for crippled children program not available for computation of rates.

NOTE: Annual figures in all tables based on 5-week survey (Mar. 15-Apr. 18, 1959) of admissions to short-term general hospitals in New Jersey.

half of these patients come from the general assistance rolls, and all but a small proportion of the others are on old-age assistance or aid to dependent children. This situation reflects, of course, the fact that the three programs, General Assistance, OAA, and ADC, account for over 95 percent of all the persons receiving some form of public assistance.

When placed on a rate basis, the general assistance and disability assistance programs have the highest hospitalization rates (164 and 129 per 1,000 recipients, respectively). The relatively high rate for persons on disability assistance is understandable in view of the nature of the program, while the comparatively high figure for general assistance is undoubtedly a reflection of the fact that ill health and indigency are often interrelated.

The lowest rate in the public assistance program in New Jersey is found among persons receiving ADC. In part, this is attributable to the special age composition of the group; that is, it is heavily weighted with children. (Because of the small number of cases, rates for aid to blind could not be calculated.)

Contrary to what may have been expected, the rate for OAA is not very high. This, however, requires some explanation. A large proportion (18 percent) of those on OAA rolls are in nursing homes and public medical institutions and are not available for admission to

general hospitals in the usual way. Exclusion of these persons from the number of OAA recipients increases the rate from 117 to 142 per 1,000, which is close to the highest, the rate for general assistance.

Important as the number of public assistance cases are to the hospitals in providing general service ward care, the medically indigent represent a far more significant group. The 5-week survey showed that in New Jersey, the volume of admissions of medically indigent is two to three times that of persons on the public assistance rolls. On an annual basis, there are an estimated 32,080 admissions of medically indigent persons as compared with 12,640 for all public assistance programs combined.

A sizable segment of the hospitalizations of the medically indigent and those on public assistance is accounted for by the aged. About a fourth of the admissions in the latter group involve persons 65 years of age or older (table 2). In view of the inclusion of OAA in this category, this high a proportion is understandable. With regard to the medically indigent, the proportion is not much less. The aged account for almost a fifth of the hospitalizations, although only 10 percent of the total population in the State are 65 or older. The discrepancy is due to some extent, of course, to higher hospitalization rates among the aged

Table 2. Percent of general service ward care in New Jersey hospitals accounted for by persons 65 years or older, public assistance recipients and the medically indigent

Pay status on admission	Percent of admissions accounted for by those 65 or older	Percent of days accounted for by those 65 or older
Public assistance-----	22.8	34.3
Categorical assistance--	¹ 38.1	¹ 58.2
General assistance-----	8.7	13.5
Medically indigent-----	19.3	28.7

¹ Virtually all of the aged are OAA recipients.

NOTE: Data for the country as a whole show that 10.4 percent of all patients discharged from short-term general hospitals were 65 years of age or older; these patients accounted for 18.0 percent of all hospital days. Part of the difference between these figures and New Jersey's is due to the exclusion from national data of hospital care for persons who died during the year.

SOURCE: U.S. Public Health Service: Health statistics from the U.S. National Health Survey. Hospitalization: patients discharged from short-stay hospitals, United States, July 1957-June 1958. PHS Pub. No. 584-B7. Washington, D.C., U.S. Government Printing Office, 1958, 40 pages.

than in the population generally. Another important factor is unquestionably the existence of lower incomes among the aged combined with less extensive coverage by Blue Cross and other types of health insurance in this group.

Days in Hospital

In addition to volume of admissions and rates per 1,000 persons receiving aid, another element that must be considered is the duration of stay per hospitalization. Table 1 shows that the average length of stay is high in all groups, including the medically indigent, except ADC. In the general population in New Jersey, the average is far lower, about 8.2 days per admission to short-term general and other special hospitals (2). The reasons for the difference are not clear, but age differentials alone probably do not explain it. More significant may be the greater prevalence of serious illnesses among the indigent and possibly a pattern of use of hospitals that results in more long-term stays.

This conjecture is supported by the data in table 3 which gives the proportion of patients that stay in the hospital for specified periods of time. While the figures may not appear un-

usually high for the aged (OAA recipients), the fact that large percentages of general assistance and medically indigent patients were in the hospital for 25 or more days, for example, suggests that an intensive study of the length of stay in hospitals of indigent patients would be profitable.

The most important single measure of hospital utilization for estimating costs of a program is the aggregate number of days in the hospital. It is clear that when approached from this standpoint, many of the relationships previously taken up are not changed appreciably (table 1). The medically indigent account for considerably more hospital days than persons on all public assistance rolls combined. Projections of the 5 weeks' study data to a full year's experience indicate that the medically indigent in New Jersey spend about 352,490 days in the hospital during the year as general service ward cases. The corresponding figure for those on public assistance is only about two-fifths as large (148,460).

Local Area Data

The number of days spent in the hospital during the year by the medically indigent and those on public assistance varied enormously

Table 3. Percent of general service ward patients in New Jersey hospitals for specified periods of time, public assistance recipients and the medically indigent

Pay status on admission	Percent of patients whose hospital stay is at least—			
	8 days	15 days	25 days	35 days
Public assistance ¹ -----	42.9	23.1	11.9	6.2
Categorical assistance ¹ ---	37.8	21.9	13.3	8.0
Old age assistance-----	65.6	42.3	27.9	16.7
Disability assistance-----	47.3	28.4	16.2	9.5
Aid to dependent children-----	25.3	11.1	4.9	3.3
General assistance-----	47.7	24.2	10.6	4.6
Medically indigent-----	40.4	21.3	11.3	6.8

¹ Includes aid to blind not shown separately.

NOTE: Data for the country as a whole indicate that 29.4 percent of the patients discharged from short-term general hospitals stayed at least 8 days; 11.4 percent stayed at least 15 days; and 3.5 percent stayed at least 31 days.

SOURCE: See table 2.

Table 4. Annual number of days, general service ward admissions in New Jersey hospitals, by size of community, public assistance recipients and the medically indigent

Pay status on admission	Total State	Communities with population of—			
		Less than 10,000	10,000– 50,000	50,000– 100,000	100,000 or more
	Number of hospital days per 1,000 population per year				
Public assistance.....	25. 9	12. 4	15. 6	38. 9	52. 4
Categorical assistance.....	12. 1	7. 5	6. 8	10. 4	27. 2
General assistance.....	13. 8	4. 9	8. 8	28. 5	25. 2
Medically indigent.....	61. 1	17. 3	27. 9	32. 2	183. 6
	Estimated number of hospital days per year				
Public assistance.....	¹ 148, 090	19, 590	34, 570	24, 990	68, 940
Categorical assistance.....	69, 240	11, 770	15, 020	6, 700	35, 750
General assistance.....	¹ 78, 850	7, 820	19, 550	18, 290	33, 190
Medically indigent.....	¹ 350, 830	27, 340	61, 720	20, 620	241, 150

¹ These totals differ slightly from those in table 1 because they exclude a small number of persons who stated at time of admission that they lived outside the State.

among the counties and communities. Part of this variation is due to the large differences in total population of these units, but even when examined on a rate basis major differentials still exist. In general, areas where population and industry are concentrated have the highest rates. This shows up clearly when communities of the same general size are combined. In cities of 100,000 population the medically indigent and categorical assistance recipients have a far larger number of hospital days per 1,000 total persons than is the case in smaller size communities (table 4). The situation is especially marked in the medically indigent group, with 184 days care per 1,000 population in the large cities as compared with a rate of 32 in cities of 50,000 to 100,000. In the category of general assistance there is little difference between the rates for large and moderate size communities (25 and 29 per 1,000 population, respectively). The big drop occurs when the community size falls below 50,000.

Summary

In considering the possibility of per diem payments for hospital care of the indigent and medically indigent in New Jersey, a 5-week survey of the general short-term hospitals was conducted. Extrapolations of the survey findings

indicated that the annual volume of admissions as general service ward cases of the medically indigent was two to three times that of all public assistance recipients. Highest admission rates per 1,000 persons receiving public assistance were found in the general assistance (164) and the disability assistance (129) categories. Persons 65 years of age or older accounted for about one-fourth of the 12,640 admissions of public assistance recipients and one-fifth of the 32,080 admissions of the medically indigent.

For both public assistance recipients and the medically indigent, the average length of hospital stay was about 11 days, and almost 12 percent of both groups stayed in the hospital for at least 25 days. Hospital utilization by the medically indigent and public assistance recipients increased with size of community. In cities of 100,000 or more persons, the medically indigent accounted for a particularly large number of days in the hospital (184 per 1,000 total population).

TECHNICAL NOTES

All numbers and rates of hospitalization derived from the 5-week survey (March 15–April 18, 1959) are on an annual basis. This was accomplished by multiplying the survey data by the factor 52/5. A special inquiry to the hospitals indicated that in 1958, 18.9 percent of the total number of all admissions (private,

semiprivate, and general service ward combined) took place in the 2 months, March and April, making these months higher than average. (The expected proportion for these 2 months, if there were no seasonality, is 16.7 percent.) However, no adjustment has been made in this study for seasonality since it is not known whether general service ward admissions follow the same pattern as total hospitalizations. From the age distribution of patients, it would appear that general service ward patients are more heavily weighted with older persons and far less heavily weighted with children than the total admission group. This could very well affect the seasonality picture.

The hospitalization rates presented are extrapolations of survey data which refer to the situation that existed in the general hospitals that reported during the study period.

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Retirement at 65?

In our society we accept quite as a matter of fact today that retirement begins at age 65. There was a day when some thought life began at 40. Today we have reached a point where many people at 40 are told that to start a second career is foolhardy and impossible. But while we go along accepting age 65 as a magic age for retirement, great advances in medical science and research are gradually increasing the lifespan. It is not unreasonable to assume that in the not too far distant future we will be talking in terms of 100 years for a lifespan. It is also reasonable to assume that people will be in good health and quick of mind far beyond the age of 65, as of course a great many are today.

As the lifespan goes further toward the century mark, can we sit idly by and hold to the present concept of retirement at age 65? I think not.

One researcher recently came up with this analysis. Suppose a worker retires at age 60 and lives to age 70. He has a gift of 31,000 hours of free time which would otherwise be spent at work. If you add to this the hours of free time which we all enjoy on weekends and evenings, his total hours of free time rise to 45,000 hours. This is a quantity of time which is more than all of his previous working hours from the age of 40 to 60. His free time in retirement equals precisely half of his past working life.

In a very real sense this also represents a waste of manpower, talent, energy, wisdom, and intelligence. Sooner or later we as a society must ask

ourselves if we as a Nation can afford this waste.

The Congress, in enacting the legislation calling for the White House Conference on Aging, addressed itself to this question when it stated:

"Outmoded practices in the employment and compulsory premature retirement of middle aged and older persons are depriving the economy of their much needed experience, skill, and energy and simultaneously are depriving many middle aged and older persons of opportunity for gainful employment and an adequate standard of living."

The Federal Council on Aging said in its report to the President dated September 30, 1959:

"A broad-gauged study of compulsory retirement is needed. Retirement practices which force the separation of employees at an arbitrary age level ignore the fact that different individuals of the same age have different capacities and desires. The feasibility of flexible retirement programs needs to be examined."

It might be well for us to recall that Goethe completed *Faust* at 83; Ben Franklin invented bifocals at 78 because he wanted to continue his contribution to his Nation and the world; Helen Keller at 79 is still working for the deaf and blind; Albert Schweitzer is a young 84 now. How do you really feel about retirement at 65?—ROBERT A. FORSYTHE, *Assistant Secretary of Health, Education, and Welfare, in a speech delivered at the annual meeting of the Life Insurance Advertisers Association (Eastern Section) in Washington, D.C., March 17, 1960.*

Public Welfare Medical Care

LUCILLE M. SMITH

THE NEW JERSEY COMMISSION to Study the Administration of Public Medical Care, created in 1956, has completed and published its report (1). The commission has invited me to present a backdrop for a discussion of its report.

Let me begin by presenting some facts for the Nation as a whole. In March 1959, payments made to suppliers for medical service for recipients of all five categories of public assistance amounted to approximately \$37 million, representing an annual rate of about \$446 million (2). The number of persons receiving assistance in that month was 6.3 million.

Of these payments, 53 percent were made in behalf of old-age assistance recipients. In the four federally aided categories, additional amounts were provided in some States in the form of money payments to enable recipients to purchase medical care, probably more than \$100 million during the year.

Let us, for purposes of perspective, contrast these figures with those revealed in the first national study of welfare medical programs in 1934 under the Federal Emergency Relief Administration (3). In March and April of that year, 17 million persons were "on relief." Expenditures for medical care were \$1,700,000, or 10 cents per person per month. This amount represented from 2.5 to 3.7 percent of all expenditures for relief. In March 1959 the monthly per capita figure was \$5.93 and medical expenditures represented 12 percent of all assistance costs.

Increase in Complexity

These figures reflect not only the general increase in medical care costs but a complex of factors: more use of hospital and nursing home

care today than 25 years ago, more older people in the population, more disabled persons surviving to require long-term care, improved quality of care, and wider recognition of the importance of health services. To fully understand what the commission expects of welfare departments requires recognition of these changes and of experiments and emerging trends in new ways to organize health services.

New Jersey was 1 of 26 States which had a successful program under the Federal Emergency Relief Administration. It was statewide except for Hudson County, which provided care through its public hospital and outpatient department. The New Jersey program had a professional advisory committee, a full-time medical director who served without compensation, and detailed policies and procedures, including fee schedules. Although Federal funds were not then available for hospitalization, New Jersey, like six other States, met these costs from State or local funds.

In a sense, those of us who knew the Federal Emergency Relief Administration feel a nostalgia for the days when there were no categories, no complicated eligibility conditions, and there was only one public welfare medical care program. Although we can't turn the clock back, that early experience confirms the soundness of many of the commission's conclusions and recommendations which are consistent with that successful experience.

It is an understatement to say it will be more

Mrs. Smith is chief of the Health Services Organization Branch, Division of Public Health Methods, Public Health Service. The paper presents the substance of a speech delivered by Mrs. Smith during the 58th annual conference of the New Jersey Welfare Council, November 18, 1959, in Atlantic City, N.J.

difficult to have a successful medical care program in 1960 than it was in 1934. But having been successful once, I am sure New Jersey will be again.

Patterns of Administration

To return to the present era, let us examine the variety of ways in which public welfare medical programs are administered. As of the most recent count, 38 States make vendor payments for some medical care services.

The variation in scope of services ranges from a comprehensive program covering preventive, palliative, and restorative services of all kinds to a program which only purchases drugs. In a sense, therefore, it is a fiction to say that 38 States have a medical care program. Without sufficient scope in the services included, quality of care is not available.

In two States, Hawaii and Maryland, the public health department acts as agent for the State public welfare department. In one State, the department purchases services by contract with the Blue Cross organization which receives and pays bills for certain services on a cost-plus basis in old-age assistance. In the same State, in aid to dependent children and aid to the blind programs, recipients are given Blue Cross and Blue Shield coverage on a pre-paid insurance basis. In another State, the State medical society administers the program for the welfare department. In still another, the State pharmaceutical association acts as agent of the welfare department for the purchase of drugs, and the agency itself purchases all other services. In another State, the physicians' services organization has contracted to administer the plan for the State public welfare department. Thus a few States have moved to transfer partial responsibility for medical assistance to official or nonofficial agencies concerned with the purchase of medical care. The bulk of the public welfare agencies, however, are administering the program themselves, often with little relationship to other agencies which also carry medical care responsibilities.

A Series of Paradoxes

This is one of the many paradoxes in public welfare today. Let's look at some of them.

"Do-it-yourself" has become a popular slogan in recent years for homeowners, but for public welfare administrators it is a dangerous practice. The State medical and dental societies, the State health department, the hospital association, and other health-oriented organizations have a vital role to play in the public welfare medical care program in every State.

Another paradox is the physicians' role in public assistance.

In view of the comprehensive nature of many medical care plans and of the vast sums expended, it has always seemed to me ironical that few States employ medical directors. In addition to the 2 health officers who direct the medical assistance program, only 11 States employ physicians to administer the medical care program. And this in agencies which employ a supervisory ophthalmologist to determine blindness and psychiatrists and internists to determine disability! Moreover, I am told, that in many States the excellent diagnostic information secured to determine eligibility is put to no further use. Medical services purchased are usually remedial—rarely are preventive or restorative services purchased. Thus, we are increasing the number of disabled who will continue to require large sums for their support, including their medical care.

Fortunately, some communities have begun to look for ways in which early diagnosis and treatment services can prevent disabling illness, and at other projects designed to restore the disabled to self-care. Hopefully, the 1956 amendments to the Social Security Act, stressing self-help and self-care, will motivate many agencies to undertake such projects. Let me give you a few examples of demonstrations in California and New Jersey that have proved most successful.

In Santa Cruz County, Calif., the local health department offers a physical screening and treatment program to all old-age assistance recipients who wish to enroll in the program. Costs are met through a combination of ingenious financial arrangements. The welfare department considers the physical screening phase a part of its determination of need and for this reimburses the health department from its administrative fund, thus securing half the cost from Federal funds. The State's medical care

program meets the costs of home and office visits and some drugs. Surgery, drugs not provided through the State program, and dental and ancillary services are financed by local health department funds. This program which has been operating since September 1955 has served 1,501 recipients or nearly one-half the total old-age assistance caseload in the county. Three clinic sessions are held weekly. A distinguished retired physician who serves without compensation conducts the history and physical examination. A public health dentist, public health nurse, and social worker are provided by the health department.

In a paper recently presented to the State directors of chronic disease programs, Dr. Russell S. Ferguson, health officer of Santa Cruz County, described the program in detail pointing out the financial savings as well as the better health which resulted from prompt identification of medical need and a team approach to developing a treatment plan. He concludes that important results have been achieved through this project:

"First, an increased interest by the individual with respect to the future maintenance of his own health achieved by the screening examination and the immediate reference to the physician of his choice. Second, through our mobilization of every financial and community resource we have been able to provide the vendor of medical, dental, and ancillary services and the recipient with means whereby the latter's health may be maintained. Third, we have been able to restore these people to the dignity of private patients in private hospitals for surgical care resulting in impressive savings to the county and restoring to the surgeon his privileged relationship with the patient. Finally, we are convinced that these services can be provided at exceedingly low cost and do contribute to the prevention of long-term illness involving institutional care and the prevention of blindness" (4).

Within New Jersey, following the mandate of the Prevention of Chronic Illness Act, a project was designed in 1955 to make restorative services available to selected persons receiving public assistance. Many of you probably know of the restorative services unit of the Essex County Hospital in Belleville. It was financed

by a combination of State health and county welfare funds and with joint planning by official bodies, seven community hospitals, and the Essex County Medical Society. The focus of this project was on restoration of chronically ill and aged individuals to self-care.

Many of the patients had a long history of hospitalization and most were bedfast or chairborne. Of the 188 admissions to the project, 143 outlived the study period. Of these, 75 percent were bedfast on admission, but only 3 percent were bedfast on discharge. The study documents the savings in dollars, in use of expensive medical facilities, and last but not least in human dignity and self-sufficiency. A report of the study presented before the 1958 annual meeting of the American Public Health Association was prepared by Adriane V. Duffy in collaboration with Marguerite F. Hall. Following the pattern established at Essex County Hospital, this type of professional, technical, and financial assistance is being extended by the State health department to other community hospitals in order that restorative services may be provided as soon as possible after the onset of illness. Such measures are designed to prevent disabling impairments and to minimize the disruption of family life.

Both of the projects described illustrate new trends in public health administration that should be of as much interest to welfare departments as are the recent amendments to the public assistance titles of the Social Security Act concerning matching of expenditures for medical care. The latter made more Federal money available to State agencies and also made possible simplifications in the purchase of medical services for public assistance recipients. They did not—and were not devised—to assure the availability of the highly specialized preventive and restorative services needed by these recipients. More and more, the role of public health departments is being shaped to include this important responsibility. The Santa Cruz and Belleville demonstrations, hopefully, will stimulate other county health and welfare departments to combine resources to get preventive health services to recipients at an early date.

New Jersey is the only State in the Union which has set out to make homemaker service

Recommendations

The following summarizes the Report and Recommendations of the New Jersey Commission to Study the Administration of Public Medical Care. The publication is available from the New Jersey State Department of Institutions and Agencies.

"Organized medical care in the widest sense of the word has come to be recognized as essential to the effective and economical operation of the public assistance system as well as to the welfare of needy persons. There is hardly a more fascinating chapter in the history of social organization of medical care in this country than the story of the progress from repression of pauperism to rehabilitation of the recipient of public aid; from provision of some medical treatment and minimal custodial care to that of a wide range of protective, curative and rehabilitative health services; and from reluctant acceptance of paupers to eligibility of all persons receiving basic income maintenance and increasingly of medically needy people," Dr. Franz Goldmann stated in his book "Public Medical Care" (1945).

The commission believes that it is in the spirit of this statement by Dr. Goldmann that the medical care program for all the needy of the State should be organized and administered. They believe that there is a base on which a good program can be developed but that some realignment is necessary both in administration and financing.

The commission believes the duplication of administration by multitudinous agencies should be abandoned and that the county welfare boards administering the four categories of aid could best be developed as the units to administer all the medical care programs for the needy as well as the medically indigent.

Well-organized comprehensive medical care programs require the advice and counsel of trained medical practitioners who should be assisted by the services of professional medical social workers and other consultants in the allied disciplines representing dentistry, optometry, hospital management, nursing, and others. The medical unit should have the services of technicians to implement special studies.

There should be communication with the professional organizations representing the suppliers of medical, hospital, and allied services through desig-

nated members serving on committees consulting with the professional personnel of the agency.

A comprehensive program should include the gamut of medical, hospital, and allied services any or all of which may be necessary to care for the needs of the recipients. The individual or institution providing the services should be paid directly on a fee-for-service based on a negotiated fee schedule. Hospital rates should be established on the basis of a reimbursable cost formula acceptable to the department and the hospital association.

The present lump-sum appropriation system for voluntary hospitals and nursing organizations should be abandoned as administratively unsound and economically indefensible.

Those persons who are ordinarily self-supporting, but because of illness become medically indigent, should be the responsibility of the county welfare boards on the basis of established criterion of need. This criterion should be established by the board of control of the department of institutions and agencies.

The obligation to repay the agency for medical expenditures should be established for the general assistance recipients and the medically indigent by rule of the department. This obligation should take into consideration the individual's particular circumstance and the burden of high cost medical care, particularly hospitalization.

Financing of hospital care for all those persons who are in need should be borne more equitably by the Federal, State, and county governments. The municipalities will be participating by their contributions to the county tax funds.

The commission believes that a medical care program for those in need and the medically indigent in which the executive officer, the legislature, and the people of New Jersey can take pride is the objective of this study. The program should have a sound legal base and good professional administration so that it fulfills the purpose of serving those in need in a wise and humanitarian spirit.

The success of the program will be determined by the interest and competence of those who have the responsibility for the administration of medical care for those who cannot provide it for themselves.

available to everyone who needs it, and the goal is more than half reached. Now 14 agencies offer homemaker service in 13 counties. Three other counties are working toward establishment of a program. This is another instance in which the health department has undertaken to create the availability of services and in which public welfare participates actively both in planning and in financing the service.

When communicable diseases were the major focus of public health programs, a battery of laboratory, diagnostic, and treatment services were made available to help practicing physicians give good care to their patients. So today when chronic disease is the major public health problem, health departments are developing new techniques of therapy and new methods of organizing health services so that they can offer to the practicing physician the services of public health nursing, medical social work, physical therapy, and occupational therapy which, when coordinated under the physician's direction, will bring long-term patients the kind of care that meets their needs.

Guidelines

To help public welfare agencies arrive at some simple "do's" and "don'ts" in undertaking the very important task which is laid out by the commission's report, let me summarize a few of the "do's":

- Consolidate your local efforts into units of workable size. It is folly to think of 500 local medical plans in the State; 21 is a reasonable number.

- Appoint in each county one or more advisory committees to help develop the county adaptation that will meet the requirements of the State plan and make best use of the local resources. Choose the public-spirited leaders from medicine, dentistry, nursing, social work, and other health interests to help you. Hospital and nursing home administrators and directors of visiting nurse associations are logical candidates for membership. In my judgment, the health officer or his representative is a "must" on such a committee. To balance the health interests, it is well to include representation from industry and labor and the lay public.

- Employ a good medical director, full time wherever practical. In selecting him, do not overlook the physician who has had administrative experience in industry, in group practice, or in the military service.

- Look to the medical society for guidance. Their help is a sine qua non in designing and carrying out practical policies and procedures. At the outset take to them your little problems as well as the big ones so they can know of your failures as well as successes. This will assure that their interpretation of the program to their fellows and to the other purveyors of health services is a true reflection of what the agency means to do and why and how it does so.

- Make a plan for seeing the official publications of national agencies that can keep you abreast of developments in medical care. The journals of the American Dental Association, American Hospital Association, American Medical Association, American Nursing Home Association, American Public Health Association, and the American Public Welfare Association all carry articles of value to administrators of public welfare medical care programs. The same is true of the *Social Security Bulletin* and the Public Health Service's *Public Health Reports*. Two less technical publications which the American Medical Association publishes for free distribution have real value for you—*The AMA News* and the *Chronic Illness News Letter*. Shortly, the AMA will begin publication of a *Bulletin on Homemaker Services*.

The American Public Welfare Association has a series of publications specific to the administration of public welfare medical care programs, "The Physician in the Public Welfare Agency," "The Medical Social Worker in the Public Welfare Agency," "Self-Evaluation Schedule for Medical Assistance Programs," "Improving the Quality of Tax-Supported Medical Care," and "Medical Care in Public Welfare" (report of Institute III), to mention only a few. All of these are for sale by the association at a modest price.

- Plan for at least an annual meeting where medical directors can share their experiences. A group council such as the New Jersey Welfare Council provides a readymade vehicle for such sessions.

- Encourage your medical directors to at-

tend regional meetings of the American Public Welfare Association and the biennial round-table so they can talk with their counterparts in other States.

There are a few cautions I should like to advance in the "don't" column:

- Don't regard the medical assistance program as merely a purchase-of-service program. It is much more than that. Be concerned with health maintenance and health promotion. Give serious consideration to the evaluation of present services and redirection when indicated. Make use of diagnostic records to plan with recipients for the treatment they need.

- Don't allow the costs of hospital and nursing home care to cloud your vision. In my judgment, preoccupation with these two types of service prevails throughout the entire United States in spite of the fact that most people who are ill or disabled are at home and prefer to be cared for there. Give services for patients at home a high priority.

- Don't work in isolation. Especially learn the differences in philosophy and objective of other official agencies like the health or rehabilitation departments and develop a systematic method of cooperation with them.

- And, finally, don't be discouraged. You are on the eve of one of the most exciting tasks you will ever have. I once organized a local medical care program with the active help of all the organizations I have mentioned. It took about 9 months to develop basic policy and procedure. They were the most rewarding months of my life. I had more help from more people than in any corresponding period of my 35 years of work. I wish you the same good fortune.

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Community Health Administration Studies

During the past several years, the W. K. Kellogg Foundation has awarded grants to three State health departments (California, Florida, and Washington) and to the schools of public health of three universities (Johns Hopkins, Michigan, and Toronto) for development of studies in community health administration. From these studies the Foundation hopes will emerge new relationships and patterns of public health practice for both the schools and the operating agencies.

Directors of the studies held their first meeting in Washington, D.C., on March 17 and 18, 1960. The meeting was sponsored by the Foundation to provide an opportunity for exchange of viewpoints and experience and to discuss common problems. H. H. Hasson, associate director of the division of medicine and public health of the Foundation, requested Dr. William F. Mayes, assistant chief, Division of General Health Services, Public Health Service, to assist him in planning the meeting and to serve as its chairman.

Social Science in Family Medical Care

ELIOT FREIDSON, Ph.D., and GEORGE A. SILVER, M.D.

THE CHANGES taking place in medical practice all over the world are reflected both in medical knowledge and in the roles of professional workers associated with the techniques of medicine. Efforts to reconstruct a stable system of medical care appear to stem from a number of objectives.

Most people would agree that any system of medical care should first make full use of all the modern knowledge and equipment available to produce the scientifically accurate diagnosis and treatment we call good care. It should offer a worthy and dignified role as well to the professional practitioners who are to provide that care. Also, and by no means to be taken as academic, it should be so constituted that prospective patients will choose to take full advantage of the benefits offered by such care.

There is general agreement on these objectives. But a controversy hinges on the form of organization by which they may be achieved.

This report describes an experiment in medical care that sought to fulfill these objectives, some of the findings of the study of that experiment by a social scientist, and the way in which these findings may aid in reformulating the organization necessary to achieve full use of such medical care by the public.

Family Health Maintenance Demonstration

At the Montefiore Hospital in New York City, there has been in operation since 1950 a program of comprehensive medical care on a prepayment basis for 150 families. Services are given not by individual practitioners of the various specialties, but instead by a functioning

health team composed of an internist, a pediatrician for children under 13 years of age, a public health nurse, and a social worker. This is the Family Health Maintenance Demonstration (1,2). The families were selected at random from a large group of those insured under the Health Insurance Plan of Greater New York (3). The health team gave the family a baseline examination, conferred with the family on the findings, and supplied comprehensive medical care over a 4-year period. At the end of the 4-year period, the team made a second evaluation of the family's health.

Comparable data were also obtained for a matched control group, substituting the services of individual practitioners from the Montefiore Hospital medical group for the demonstration health team. The demonstration originated within this medical setting. In essence this was a controlled experiment on the effect of an organized medical care program on health. The study families were given team-organized services while the control families continued to use the individual services of the medical staff of the Montefiore Hospital medical group, and the health of both groups was assessed in the same way at the end of the program.

Part of this experiment was designed origi-

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nally to determine what health education and promotion techniques would influence the health of families favorably if added to health programs (1). Of course, arbitrary criteria were used to define "health education," "health," "favorable," and the like. Health, for example, was defined as capacity to function successfully in four major areas—work, sex, play, and family life. By these criteria, it was found that the program was not successful in improving the health of families. At the same time, however, team organization of medical care was successfully demonstrated and seemed highly satisfactory to the patients.

The Role of Social Science

The social scientist could take no active or manipulative role in the demonstration. By its controlled nature, changes could not be introduced. Instead, the social scientist sought to study, in a broad, exploratory way, the relation of the organization of medical practice to the behavior of patients. Attention was concentrated on the patients' conceptions of professional practitioners and the processes by which the patients use the services. Through this study, hypotheses were developed about the conditions under which professional services could be used, based on a theoretical framework which stems from communications research and anthropological conceptions of the community.

Analysis of the findings seemed most appropriate within the context of an organized process of interpersonal influence similar to that described by Katz and Lazarsfeld (4). The process seems of particular significance when the patient is uncertain, as on occasions when he must select a new doctor, or when he uses a doctor for the first time, or when he is undergoing mild suffering from ambiguous symptoms and cannot decide how his illness should be treated or whether he should consult a professional practitioner about it. Whether or not this uncertainty occurs is, of course, largely the result of the culture or knowledge of the patient. But when it does occur, the course taken seems to be determined by the lay culture in which he lives and the network of lay and professional consultants to whom he turns for help. We have chosen to label this the "lay re-

ferral system." The lay referral system is paralleled by the professional referral system, with its own culture and network of consultants and colleagues.

Use of Services

The primary objective of the Family Health Maintenance Demonstration was to experiment with team organization of health services (5). It became clear rather early that one member of the professional team, the social worker, was not being consulted to the degree considered appropriate by professional standards. This was not due to a lack of personal problems in which a social worker could assist, since members of about one-third of the families were recognized as having such problems. Neither was it due to the patients' failure to recognize that they had such problems, for they did seek help from other team members.

Research by intensive interview and questionnaire suggested that the role of the social worker in the team was both culturally and structurally isolated from the lay referral system (6). The patients seemed to avoid using the social worker because her professional role was segregated not only from medical problems but also from such everyday affairs as nutrition, housing, and the children's schooling. In consequence, the social worker came to be defined by the patients as a specialist rather than an everyday consultant. Functionally, a specialist is consulted only after exhausting more commonplace resources. In avoiding the social worker and seeking the aid of the public health nurse and the physician for their personal problems, the patients were in essence seeking less specialized aid.

Thus it was hypothesized that because of the cultural background of these patients, early use of the social worker as a preventive measure could be expected only if her role were changed to more closely resemble, for example, that of the public health nurse, which was more informal and more concerned, on the surface at least, with the manifest medical, economic, and interpersonal affairs of everyday life. This role was subordinate to and chronologically was used prior to that of the physician in the process of defining illness and seeking

aid, standing as it did between that of the physician and that of some such lay consultant as a relative or friend. However, if the social worker's role was not changed and if the patients' culture remained unchanged by an educational campaign, it was concluded that the social worker would be used primarily by those few who believed themselves to have exhausted "ordinary" sources of help, and thus conceded the "special" nature of their problem.

Use of the social worker reflected the organized process of seeking help stemming from the concept of the lay referral system. This was also seen to be the case in the use of medical services.

Eleven percent of the families (13 of the 117 responding) reported that some member of the family at his own expense had a surgical operation performed or a child delivered by an independently practicing physician while the family was enrolled in the demonstration and was entitled to this medical care under the terms of its subscription. For more everyday, nonsurgical services, 6 percent of 119 families indicated that some member had used the services of an independent practitioner "quite a bit," and an additional 31 percent reported that an independent practitioner was used "occasionally" at out-of-pocket expense.

But an overwhelming proportion of patients were far more satisfied with the health team organization of care than with care received from individual practitioners, either in group or independent practice. Ninety-two percent of the families responding believed that the health team demonstration was more beneficial to them than care received from the Montefiore Hospital medical group, and 85 percent concurred in approving the health team when comparing its care with that received from their prior "private doctor." Also 94 percent stated that it was more pleasant to be a Family Health Maintenance Demonstration patient than to be a Montefiore Hospital medical group patient, and 74 percent stated that it was more pleasant to be a demonstration patient than to be the patient of a "private" doctor outside either scheme.

There seems to be a contradiction in these data. If so many patients believe that the

demonstration is beneficial to their health and pleasant to use, why did one-third of them use outside services? On the whole, and we must compress a good deal of data here, two things seemed to be involved in the use of outside services—the patient's assessment of the quality of medical care available to him and his assessment of the importance of his medical complaints. In what seems to be the bulk of the instances of use of outside services, the patients assessed their complaints as minor, and assumed that for minor complaints any physician is competent. Under such circumstances, simple convenience seemed to dictate the occasional use of a neighborhood, independent physician rather than the demonstration physician at the centralized medical group. This was particularly the case for home calls at night when the demonstration physician was unavailable, and other physicians of the medical group were on call in rotation. In this situation, of course, the ability to pay the fee of the independent practitioner is an important element. It was found, in fact, that the use of outside services increases in general as social class, and its contingent ability to pay, rises.

Where just convenience is involved and the illness does not seem to be critical, typically the patient acts as an individual, without interaction with lay consultants. This is not the case in more analytically interesting instances when the patient feels some anxiety about the illness and becomes uncertain about the qualifications of the physicians involved. On these occasions, the relationship of the lay referral system to the professional referral system becomes quite important.

Analysis of instances of the use of outside service, probed during intensive interviewing, has not been completed. But at present it seems that the necessity to use a specialist rather than the everyday family health maintenance physician, whether for surgery, child delivery, or special therapy, seems to be common to all instances that do not rest on sheer convenience. These were cases where referral from the demonstration to a Montefiore medical group specialist was not sustained. And, by definition, these were cases where referral implied the illness was serious. In these cases,

the diagnosis or the referral or both were questioned by the patients, and, in the course of seeking alternative diagnoses or of validating the competence of the specialist to whom they were referred, they were led outside the medical group.

This difficulty in professional referral seemed to stem in part from the very mode in which medical care was organized. The patients rightly viewed the Montefiore Hospital medical group in which the demonstration operates as a cooperative organization. In this sense, when their demonstration physician referred them to a medical group specialist, they believed that the referral was necessarily to the man who happened to be working in the medical group, and not necessarily (but of course possibly) to the so-called best man in the field. The patients who went outside wanted what they believed to be more disinterested validation of the quality of the physician to whom they were referred. Disinterested sources of validation, however, are also outside the professional organization of the group—"private" physicians and the lay community. In those few cases recorded where temptation to use outside services existed but was resisted, the patients happened to obtain recommendations of the group specialist to whom they had been referred from lay consultants who knew the work of the specialist or, in one case, from an independent "private" physician. The major source of such validation of professional quality appears, in fact, to lie in the lay referral system, so that we may expect those patients whose lay consultants do not know the reputation of the medical group physicians to be subjected to interpersonal forces that encourage the use of outside physicians. Some statistical evidence to support this conclusion has been gathered.

On the basis of these exploratory findings, it was hypothesized that a medical care organization has a better chance of holding its patients through all contingencies if the patients interact with each other in inclusive natural networks of interpersonal influence. Where patients are unknown to each other and yet they participate in a number of lay referral systems the bulk of whose members have no experience

with the medical organization in question, it is to be expected that use of the service will be diminished to some extent.

Application of the Findings

As Katz and Lazarsfeld have shown (4), the concept of personal influence has relevance to sociometric and small group studies. We may add that it also underscores the relevance of comparing anthropological studies of "little communities" (7,8) with studies of urban aggregates (9). The concept of the lay referral system allows us to consider simultaneously the culture, or "health education," of the patient, his participation in a highly influential network of lay consultants, and, finally, the structured relations which exist between the lay and professional worlds. This relevance is most extensive in instances where patients have a considerable latitude of choice between practitioners, a situation characteristic of some parts of the United States but not of some other countries (10,11). It is also relevant to any medical system where the patient may at least choose not to use available medical services at all (12).

In the program described here, however, and in future plans for similar programs of research in modes of family health care, a number of implications have emerged. First of all, it may be observed that the picture of society that it gives us is one obviously incompatible with viewing the patient as an isolated individual or even as a member of an isolated nuclear family. In future experiments with the organization of medical care, it seems that we must deal with the patient as a member of a network of interpersonal influences. This means that a fruitful source of study populations may lie more in such networks than in individuals selected at random. A selection of such networks should also include the members of the network to whom others would naturally turn for medical and personal advice and guidance. After influencing these "influentials," health education may not continue to be unsuccessful in modifying behavior, and, as hypothesized, patients might be more thoroughly "held."

In a future program, it seems also that the social worker need not be used as a primary teamworker. The public health nurse's role could be exploited to greater effect and her ef-

fectiveness increased by adding the benefits accruing from more extensive training in case-work and psychiatry. The day-to-day team would thus be smaller, composed of two physicians (one for adults and the other for children) and the public health nurse. The social worker, however, might continue in close liaison with the team, but not on a full-time basis: she could represent the first echelon of referral for emotional difficulties in those families which recognize and accept the fact that psychiatric care is required.

Finally, it might be said that both the demonstration and the findings of the social scientist in his study of it have had important and encouraging implications for social policy. The popular fear of governmental or private large-scale medical service in the United States seems to be based on the fear of loss of personal attention in a bureaucratic setting. Team practice, as it was observed in the Family Health Maintenance Demonstration, seems to provide the attention desired, even though the setting is bureaucratic, since the patients expressed a high degree of personal satisfaction with the care they received.

A notable aspect of this satisfying team action was the family conference, an annual, hour-long discussion between parents and professional team members which seemed to allay suspicion, deflect hostility, and offer a unique opportunity for the exchange of information. If such team practice could be integrated into

the informal conferences that take place between patients and their lay advisers, it might be possible to allay even those instances of suspicion occurring when patients are referred to specialists in a bureaucratic setting.

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Research in Health Departments

A regional conference on the opportunities for research in local and State health departments, sponsored by the Public Health Service, drew representatives from six States to Atlanta, March 14-16, 1960.

The conference included a demonstration of the operation of a study section, reviewing grants applications, with reference to specific projects or research proposals. The study section members benefited no less than the audience from the discussion. The need for communication guiding information from the National Institutes of Health to the principal investigators and applicants was emphasized repeatedly.

It was the consensus that such conferences in other regions would be helpful to health officials.

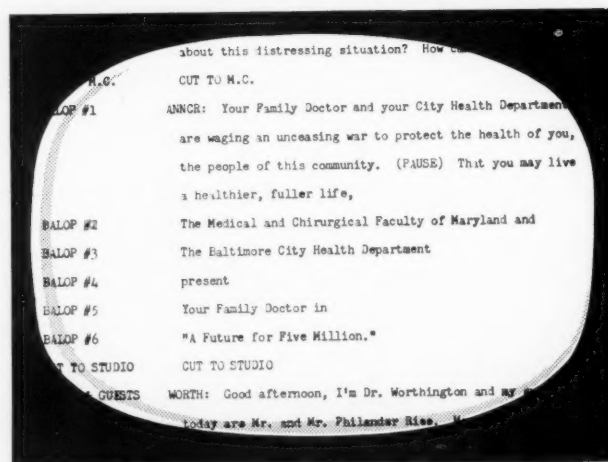
Health Television Series in Twelfth Year

IN DECEMBER 1959, Baltimore's health information television series, "Your Family Doctor," began its 12th consecutive year. The series, commencing December 15, 1948, is not only the oldest continuously produced medical television series, but now has one of the longest consecutive runs for a television series of any type. From this, one may infer a sustained viewer interest and demand for health information through television.

On a surprisingly small budget, the Medical and Chirurgical Faculty of Maryland and the Baltimore City Health Department have presented more than 550 programs in this series. Cooperation by many interested groups has kept production costs low. Broadcast time and facilities are contributed by station WMAR-TV. Civic organizations regularly provide speakers, panel members, and actors. A Boy Scout group, *upper right*, participated in a pre-Christmas "Home Safety" show, and an American Red Cross swimming class, *center*, in an early summer "Swim Safely" program.

Health directors who contemplate producing a television series or a single program may obtain information regarding the availability of source materials from the World Health Organization, Division of Public Information, Palais des Nations, Geneva, Switzerland; from the Pan American Sanitary Bureau, 1501 New Hampshire Avenue NW., Washington 6, D.C.; from the Public Inquiries Branch, Public Health Service, Washington 25, D.C.; or from the Bureau of Health Education, American Medical Association, 535 North Dearborn Street, Chicago, Ill. Sample scripts used in the Baltimore series may be obtained by writing to Dr. Huntington Williams, Commissioner of Health, Baltimore City Health Department, Baltimore 3, Md.

Portion of a script used in Baltimore series.



The Sweep and Excitement of Science

JOHN R. PLATT, Ph.D.

THE tremendous interest of the public in science today, I think, can be attributed to two main factors. One is the headline role that technology is now playing in war and in public affairs. It inspires readers to learn more, uniting their curiosity with good citizenship. But much of our fascination is also due to the skill and devotion of teachers and writers, editors, and broadcasters, who are trying to present the story of science to the mass audience and to explain in simple terms just how atomic piles, computers, and satellites work and what they mean. Interest feeds on explanations. The more we get, the more we want, from 4 years of age onward.

Science no longer needs to be explained just to laymen and citizens and children; it now needs to be explained to statesmen and philosophers and even to scientists themselves! The poor scientist can never keep up with the hundred thousand research papers that are published every year, and so he becomes a layman too, in every field but his own, and an important part of the mass audience. There will have to be writing up as well as writing down. There is a need and an audience at every level of sophistication from the nursery school to the graduate school.

What shall we give these audiences? Everyone has his own recipe, but I am sure we are all agreed today that quiz-show facts are not enough. I once heard an English chemist

criticize another English chemist by saying, "That man knows more facts that are almost right than anyone else in the world." Perhaps the American public knows more facts that are almost right than any other public in the world.

But even if the facts are right, the public needs something larger if it is to understand what science is all about. There are three particular qualities of basic science—not technology but basic science—that I think a citizen in a scientific society should be shown over and over until he begins to feel them for himself. The first quality is the excitement of science, the second is the sweep of science, and the third is the incompleteness of science.

Excitement

To say that basic science is exciting may sound like a contradiction. We are used to the really spectacular excitements of the engineers with their radar and rockets; and the life-and-death excitements of the doctors, the biological engineers, in their white coats. By contrast, the intellectual excitement of a man sitting over a microscope in a university basement tracking down a clue may seem pretty tame. But I would remind you that there are two intellectual excitements that are not tame at all and that we remember all our lives. One is the thrill of following out a chain of reasoning for yourself; the other is the pleasure of watching several strongly individualistic personalities argue about their deepest convictions. That is to say, the thrill of a detective story and the pleasure of watching a play by George Bernard Shaw. I would claim these are exactly the excitements basic science has to offer.

Dr. Platt, professor of physics, University of Chicago, delivered the address from which this article was taken before the Thomas Alva Edison Foundation meeting on "The Mass Media and the Image of Science" in Washington, D.C., November 6, 1959.

Moreover these intellectual thrills in science are not something distant or alien, but something closely continuous with our everyday thinking. It is true that science is complex. This is because so many men have been building it up for so long. Nevertheless every individual step in it is a little inference as simple as looking out at the weather and deciding whether or not to take a raincoat. When we look at a celebrated rocket engineer like Werner von Braun, we see a man running a big complex organization and dealing with incredible horsepower. But when we look at a fundamental scientist like James Van Allen, the university professor whose tiny satellite equipment detected the radiation belts around the earth, fundamentally what we see is a man stepping to the door of his planet to see how the temperature is outside.

What is essential in any science story is the little chain of everyday inference, the reasoning. It may surprise many people to know that the chain of new scientific reasoning in a whole research study is frequently less complex than an everyday business decision or a crossword puzzle or a game of chess. It would have a salutary effect on our attitudes if for 24 hours we could cross out the words "science" and "scientist" wherever they appear, and put in their place the words "man reasoning." Even in the mathematical sciences, like physics, it is the reasoning that comes first, the equations second; and the equations will not save the theory if the reasoning is wrong. It cannot be said too often that science is not mathematics, but reasoning; not equipment, but inquiry.

The master at demonstrating reasoning to a mass audience was Conan Doyle. It would not be far wrong to think of every science story as his kind of detective story, with its puzzles and its suspense, its false leads and frayed tempers, and its brilliant Sherlock Holmeses, its half-brilliant Inspector Lestrades, and its admiring Doctor Watsons. It is interesting to remember that Galileo himself used a very similar group of characters to explain his reasoning to a mass audience. Science is the greatest of all detective stories, a continued yarn that holds its audience for life, with the disagreements of the characters

nowadays just as conspicuous and as amusing as ever.

The second excitement in the science story is the excitement of personalities. Biography and belles-lettres have hardly touched the field of science. There is valuable literary work to be done here. We need a good biography of G. N. Lewis, whose department at Berkeley turned out half of the best physical chemists in America. We need one of William Moffitt, the witty and brilliant theoretical chemist at Harvard, whose death last year at 33 was a loss far greater than the loss of any headlined baseball player or movie star. We need to put our senior teachers, James Franck of Chicago and Joel Hildebrand of California, and Percy Bridgman of Harvard, on Caedmon records, like poets, for posterity. There are many stories to be found in the sequences of brilliant teachers and brilliant pupils; my own department is fond of pointing out that three Nobel Prize winners this year and last got their Ph.D.'s with Fermi at the University of Chicago.

There is more unusual material, too, such as the story of the Hungarian-American scientists so brilliant that the others call them the "men from Mars." Or the story of such a man as Leo Szilard, a strange and contradictory thinker, who has surely influenced history by his unique role in starting the atomic bomb project as well as by his pioneer landmark papers in a dozen fields. The lighter material would include the amusing yarns that all scientists know about the hobbies of their favorite personalities. There are the mountain climbers; and Luiz Alvarez' parlor tricks; Richard Feynman's lockpicking; Arthur Roberts' musical compositions; and the insults, and the jokes—like the story of the Hungarian who had a sign over his desk that said "Being Hungarian is not enough."

And there are not only past stories, but future stories in the making, the men who may get the Nobel Prizes next year, and the year after.

When the stories of these personalities in science begin to be told, I suspect that we will find that all the men have one common characteristic: they are having fun. And the fun will be contagious. It has been said that the only peo-

ple who get paid for doing exactly what they like are physicists and baseball players. When the word leaks out to the children, there will not be laboratories enough to hold the budding scientists.

Sweep

The second quality to get across to the mass audience is the scope or sweep of science. By this I mean the great range of problems covered, the range of the methods of work, and the wide range of the implications. For illustration I have selected three areas which show very different patterns of development today. One of these is biophysics, the second is what is called molecular biology, and the third is some of the recent work on evolution.

Biophysics is one of the border areas of physics. It is one of the active fronts that have radiated out from the atomic physics of 30 years ago. In one direction these fronts include the new and rich and spectacular sciences of space physics, nuclear physics, and solid state physics. In the other direction, the activity runs instead along several of the borderlines with the older disciplines, giving us the somewhat quieter fields of chemical physics, biophysics, and psychophysics, all of them largely confined to the university laboratories.

These latter areas are not sharply separated. I myself started out in chemical physics, studying the light absorption of dyes and similar molecules. I found that this led me to a study of chlorophyll which was a biological molecule and therefore biophysics. And then it led me to a study of the visual pigments of the human eye, which are the first elements struck by light in the psychological act of vision, and therefore psychophysics.

Biophysics proper is not what I call an exploding field at present but one that is just simmering along nicely. An important area of study lately has been the transfer of light energy between neighboring biological molecules. Many workers feel that such a transfer might be the first step in vision and the first step in photosynthesis, as well as the first step in the damaging of tissue cells by nuclear radiation. This makes it a hot subject and numerous international conferences on it are being held.

My only regret is that some people have chosen to call the subject "bioenergetics," which makes it sound more like a branch of naturopathy than a field of science.

Although the subject of energy transfer is of wide interest, the actual results are rather tenuous, partly because the experimental work has to be exceedingly painstaking. During a summing up session at the Brookhaven conference on this subject recently, the participants listed roughly a dozen new physical instruments and tools that they wished could be invented in order to facilitate work in this field. For example, methods are needed that would permit us to observe or infer the first chemical reaction steps of many biologically important molecules, including the primary molecules in vision, in photochemistry, in genetics, and the antibodies. Conceivably such methods of observation will evolve out of the fluorescence-interaction methods of Michael Kasha, or the tracer technique of Melvin Calvin, or the recent ingenious substitution technique of Engleberger and the Koshlands, or out of a completely new approach. The question remains open. Work is in progress.

Biophysics merges into a closely related area that today is anything but placid, the area of molecular biology. It has had an explosive development in the last 10 years. It was notable first for the numbers of physicists, chemists, and doctors attracted into it by such inspiring microbiologists as Salvador Luria and Max Delbrück. Now it is the scene of the last two Nobel Prizes in medicine, the one to Joshua Lederberg, George Beadle, and Edward Tatum, and one to Severo Ochoa and Arthur Kornberg. And sitting at conferences, one watches with pleasure and astonishment the beautiful demonstrations of the other theorists and experimenters, wondering which of them will be next to get the prize.

Will it be James Watson and F. H. C. Crick, with their two-strand model of the DNA molecule so thoroughly proved in the last few years? Will it be Meselson and Stahl, or Taylor, Woods, and Hughes, with their beautiful tracer methods of testing the model? Will it be Seymour Benzer, with his analysis of microgenetic characters a thousand times finer than any ever

examined before? Will it be Cy Levinthal or some of his competitors, racing to see who can crack the great cryptogram, the code that translates the DNA molecule into the other cell materials? Or Theodore Puck, with his method of culturing perfect tissue cells? Or Albert Coons, with his fluorescent method of labeling antibodies?

The shrewdness of such men in reasoning and experiment has brought a new atmosphere to biology. Needless to say, the older scientists are not entirely sympathetic. Oversimplification, they snort. One eminent gentleman said, and I quote: "You know there are scientists, and there are people in science who are not doing science at all. We need their auxiliary work—they build apparatus, they make minor studies—but they are not scientists."

To which the young microbiologist replies: "Well, there are two kinds of biologists, those who are looking to see if there is one thing that can be understood, and those who keep saying it is very complicated and that nothing can be understood."

Sixty years ago when Pasteur was also trying to see if there was one thing that could be understood, the audience hung breathless on his results. I think this could happen again today. At any rate, molecular biology is, next to nuclear physics, the most intellectually exciting field for a young person to enter at the present time.

A third area, still more biological, is that of the recent work on evolution discussed at the Darwin Centennial Celebration this past fall at the University of Chicago. This celebration honored the 100th anniversary of publication of "Origin of Species." Several of the papers offered dramatic new illustrations of the Darwinian principle of evolution. One of these by Nicholas Tinbergen demonstrated that it is not just bones and muscles that evolve but also behavior, and he gave numerous examples of such evolution as found in the behavior of birds that nest in cramped and dangerous places.

In another paper, F. Clark Howell and Sherwood Washburn showed from the study of old skulls that man's brain has increased in size rapidly since he began using tools and fire, and is now almost three times as large as it was

then. Another study, by Cesare Emiliani, showed that this evolution of our brains may have taken a time much shorter than anyone has supposed, only a few hundred thousand years according to new geological dates. In short, intelligent man, as we know him, may have developed with dramatic suddenness as a result of using his hands to manipulate the world around him. Perhaps we are still developing at the same remarkable rate. It was better brains that determined which of the man-creatures would survive then; and it is better brains that will help us to survive now, we hope.

At the Darwin conference there was also much said about man's population problem today, which is a terribly timely aspect of evolution. There was something like a three-cornered debate on population, between the grandson of the founder of evolution, Sir Charles Darwin; the biologist, Sir Julian Huxley; and another Nobel Prize winner, H. J. Muller. Darwin says that in 50 to 100 years, the overcrowding of our increased population will destroy our civilization forever, and cannot be reversed, because people and groups who want to have many children will go on having them, whether it is good for the whole community or not. Huxley is more optimistic and thinks the population explosion can be stopped if we are intelligent enough to find incentives for stopping it. And Muller says that it is already urgent for us to take really dramatic steps, that is, to begin selective breeding, if we want civilization as we know it to continue.

All three men are united as scientists in saying that we are doomed if we do nothing to reduce our birth rates; they differ only in how much they think, as hopeful men, that we can do nationally and internationally about the problem. Many people may not approve of scientists offering to give their scientific knowledge and counsel to human affairs in this way, just as many people did not approve of the theory of evolution itself a century ago. But I think that the reporter who has the courage to try to transmit this population debate to the public in a full and fair way may find that he has a story as exciting, as controversial, and finally as important to history, as the debate over evolution itself ever was.

Incompleteness

The intelligent layman should be told of a third quality, the incompleteness of science.

All science has gaps in it. The most familiar are the inevitable small gaps, the data that one could still go on taking, the unexamined minor assumptions, or the unresolved questions. Most of these do not bother us because we realize that a scientific age is an age of tentative conclusions and working rules that may well have to be changed later. Yet it is important for us to emphasize this incompleteness, especially to the young, because they have hopes and aspirations and they want an open-ended story, with something left for them to do when they finally take our places.

What is not so often realized is that science is incomplete in more serious ways, with gaps that scientists themselves, tied to their own narrow specialties, hardly realize the existence of. In some ways, for all its diversity, science is narrower now than it has ever been before. Few of the men who work on photosynthesis know anything about physics; few of the men who work on nervous tissue know any organic chemistry; few of the men who work on the brain have any understanding of the mind. There are exceptions. An Enrico Fermi or Edward Teller or Harold Urey can work on stars or nuclei or molecules, just as his fancy strikes him. A John von Neumann can work on quantum mechanics as well as the theory of games. A Percy Bridgman can work on solids as well as logic. But for every such man, there are hundreds who spend their lives repeating the kind of experiments they did for their doctor's degree.

Even the intellectual leaders are blind to some fields. For over a century, some of the greatest physicists, Young and Maxwell and Helmholtz and Schrodinger, thought it of the greatest importance to study human visual perception. Today, I daresay not one of the twenty leading physicists in this country would have even a casual interest in this subject. Likewise, interest in the philosophy of physics has dropped almost to zero among the bright young men; yet this field may simply be waiting for a new Ernst Mach who will stir it up and pave the way for another revolution like relativity. And we have

all noticed such blind spots in the more technical fields, where it has suddenly been discovered, for example, how badly everyone has been neglecting oceanography, an area perhaps of central importance for our future food and resources.

I think these gaps cry out for reviewers and critics broadly trained and broadly read, who are competent to see what the neglected areas are and to encourage the young to go into them. A balanced and vigorous science requires a balanced and vigorous criticism. To paraphrase Clemenceau's remark that war is too important to be entrusted to generals, science is too important to be left to the scientists. Intelligent outside evaluation is good for a department, it is good for a university, and it would be good for science itself. The incompleteness of science is a challenge to great criticism. It is a challenge which I think will be met in the very finest presentations of science to the public.

The Life of Man

It is a thrilling thing to be participating as actor or observer in the scientific revolution of our times, as science enters and transforms the life of man. Some are depressed by the hard work that must be done to make a world, and by the constant threat of failure and catastrophe. Some say philosophy has failed. I think this is only a momentary lapse between the old philosophy and the new that rises already in the laboratories. I think this century marks in history a revolution in man's outlook even more profound, if possible, than the accompanying revolution in science and technology. Man has suddenly found himself. He has explored all the earth and stepped outside it. He taps the sun's source of energy and stands ready to manipulate the weather and use the oceans. He measures back to the beginnings of time and out to the ends of space and sees his own sudden emergence, a thinking creature spun out of light and air and water and holding power in his hand, yet probably only one of millions of such creatures on other worlds.

And the power man holds is not only technical power but something far greater still, evolutionary power. He creates new species of plants and animals, halts or speeds up evolution, ma-

nipulates heredity like chemistry, and prepares to turn his own flimsy organism into whatever fantastic and brilliant and powerful form he most desires. The whole future is open-ended, waiting for us. This is not a time of philosophical decay but a time of birth. In the midst of our worry and fear, man reasoning, man the

creator, is about to be born. The old philosophies will burst off and blow away, unable to contain so fierce a fire. From now on, in every century, man will look back and say, this was the one.

When we speak of the sweep and excitement of science, we are speaking of the cradle of man.

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(With the above three "Public Health Papers" WHO launches a new series designed to stimulate international thinking, discussion, and planning by the publication of personal ideas, observations, and suggestions of individuals or groups.)

Research on Cancer Viruses

JOHN R. HELLER, M.D.

THERE IS NO DOUBT that virology now holds great promise in research efforts on the cause and prevention of cancer. Virology has but recently attained this high status. Only in the past few years has the accumulated evidence of a half century of investigation proved sufficient to convince the more skeptical scientists that viruses cause cancer in animals.

The French bacteriologist Amédée Borrel was the first to make the suggestion, in 1903, that cancer might be a viral disease. His countryman, the eminent virologist Charles Oberling, later pointed out in "The Riddle of Cancer" that Borrel reached this conclusion when he failed to find the "microbe of cancer." For years his idea was defensible "mainly because no other offered a satisfactory interpretation."

Then, in 1908, the Danish scientists V. Ellerman and O. Bang succeeded in transmitting leukemia from one chicken to another by injecting cell-free filtrates of blood and organ extracts. At that time, however, leukemia was not generally considered a neoplastic disease, so their work did not receive much attention.

Two years later, Dr. Peyton Rous, working at the Rockefeller Institute in New York, transferred certain spontaneous tumors of chickens by cell-free filtrates. One of these neoplasms was the source of the Rous sarcoma virus. This work was viewed with some skepticism because of the prevailing opposition to an infection theory, but subsequent work established beyond any doubt that these were true neoplasms and that there were no living tissue cells in the

filtrate. Now we know that Rous' discovery marked an important stage in the history of experimental cancer research. The Rous sarcoma dramatically progresses in degree of malignancy through successive passages in the laboratory, either by cell transplants or tumor filtrates (fig. 1).

In the early thirties, a young man named Dr. Richard Shope, also at the Rockefeller Institute, was studying rabbit tumors—in particular, a papilloma occurring in certain wild cottontail rabbits. Using the same basic technique employed by Rous, Shope extracted and filtered the papilloma tissue and injected the filtrate into domestic rabbits. Figure 2 shows the results after various periods of time.

The Shope papilloma agent cannot be recovered from tumors in the domestic rabbit; the animal can be infected with a filtrate, but the papillomas that arise generally cannot be transmitted from one domestic rabbit to another. Nevertheless, the presence of a virus is signified by the appearance of antibodies in the blood as the tumor develops.

Several other virus studies bore fruit during the thirties. In 1934, Dr. Balduin Lucké at the University of Pennsylvania described the transmission by a cell-free extract of kidney tumors in the leopard frog.

At the Roscoe B. Jackson Memorial Laboratory, in Bar Harbor, Maine, a geneticist, Dr. John Bittner, and others were working with inbred mouse strains. He made reciprocal crosses between high and low mammary tumor strains of mice, expecting to find approximately the same incidence of tumors in the progeny of high-strain mother-low-strain father crosses and low mother-high father crosses. But only the progeny from mothers of the high-tumor strains had the same high incidence of cancer.

In studies to determine the nature of the

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Figure 1. Sarcoma in the wing of a chicken 10 days after inoculation of the most potent Rous sarcoma virus preparation currently available

mother's influence, Bittner foster-nursed mice from high-tumor strains with mothers of low-tumor strains. The foster-nursed mice were relatively or entirely free of cancer, and so were their descendants for generations. In later studies, the reverse was also shown to be true. It was also found that a low-tumor strain mouse had to receive milk from a high-tumor strain foster nurse within about 10 days of birth, if it was to develop cancer. Thus was discovered the Bittner milk agent, now accepted as a virus.

Research in the Fifties

It was a long time before the studies conducted by the early pioneers of virus-cancer research were generally considered to be anything but isolated laboratory curiosities. Other paths of cancer research appeared vastly more promising than virology. In the last decade, however, a number of investigators have become interested in virus-cancer research, and have produced an impressive amount of information about animal tumor viruses and the fundamental nature of viruses and cell components.

The beginning of this new, active period is marked by a study by Dr. Ludwik Gross of the Bronx Veterans Administration Hospital who in 1951 successfully transmitted mouse leukemia with filtered extracts by injecting newborn

mice of a susceptible strain. His best results were obtained when he inoculated mice no more than 16 hours old. Gross also reported an unexpected result—some of the inoculated mice developed tumors of the parotid, a salivary gland, and miscellaneous other types. Many of these tumors rarely, if ever, occur spontaneously in uninoculated mice of this strain.

At the National Cancer Institute, Dr. Sarah Stewart attempted to reproduce Gross' results. But, although she used the same method, none of the mice she inoculated got leukemia. They developed primarily parotid gland tumors instead.

Teaming with Dr. Bernice Eddy, also at the National Institutes of Health, Dr. Stewart increased the potency of the parotid tumor fil-

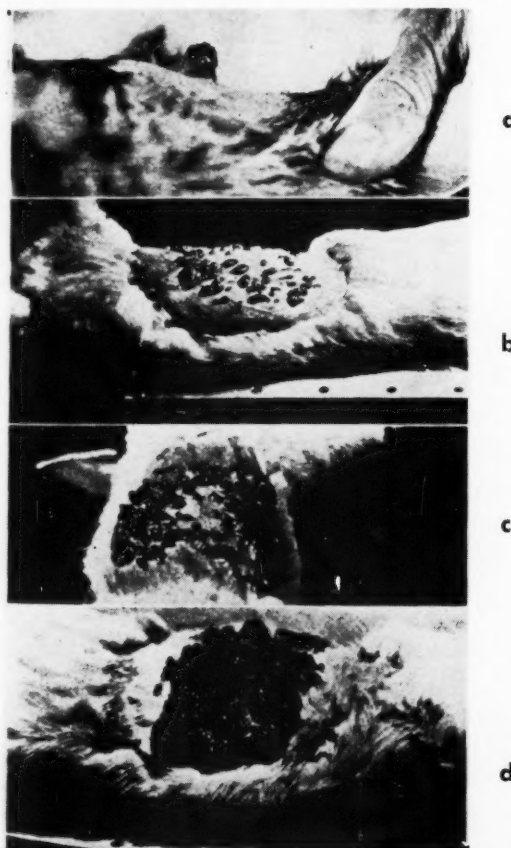
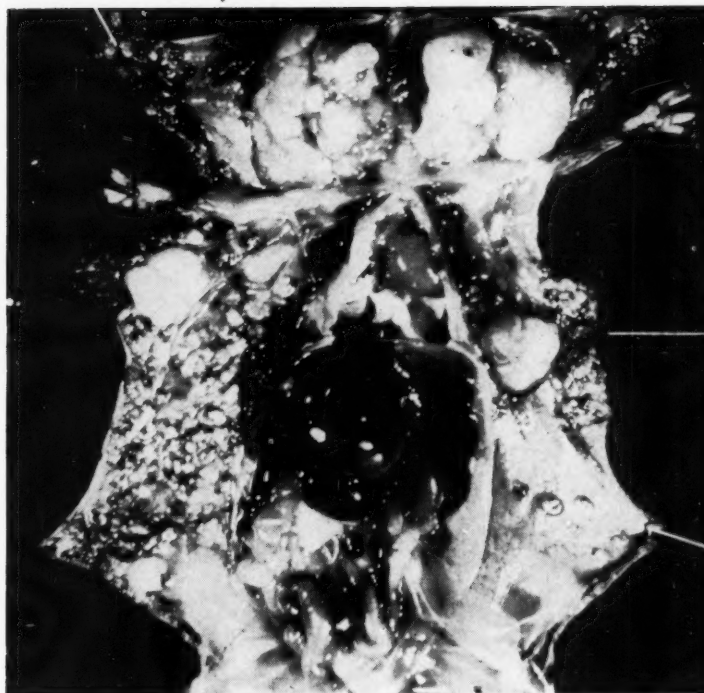


Figure 2. (a) Papilloma on the inner left thigh of a wild rabbit (under the microscope these growths resemble extremely keratinized warts), (b) result of inoculation of domestic rabbit with filtrate of the papilloma tissue after 23 days, (c) after 52 days, and (d) after 118 days

Figure 3. Autopsy of mouse inoculated when newborn with polyoma virus



trate by carrying it in tissue culture. When newborn mice were injected with this filtrate, the results were remarkable (fig. 3). Not only did the mice develop primary parotid tumors, but 22 other types of tumors as well, including tumors of the thymus, adrenal glands, and mammary glands. The agent was thus named "polyoma virus." Some of the mice developed tumors within 6 weeks. Again, none developed leukemia. The investigators obtained similar results when they inoculated mice with mouse leukemia extracts incubated in tissue culture.

It is now widely believed that Gross' original material contained two viruses, the leukemia virus and the polyoma virus.

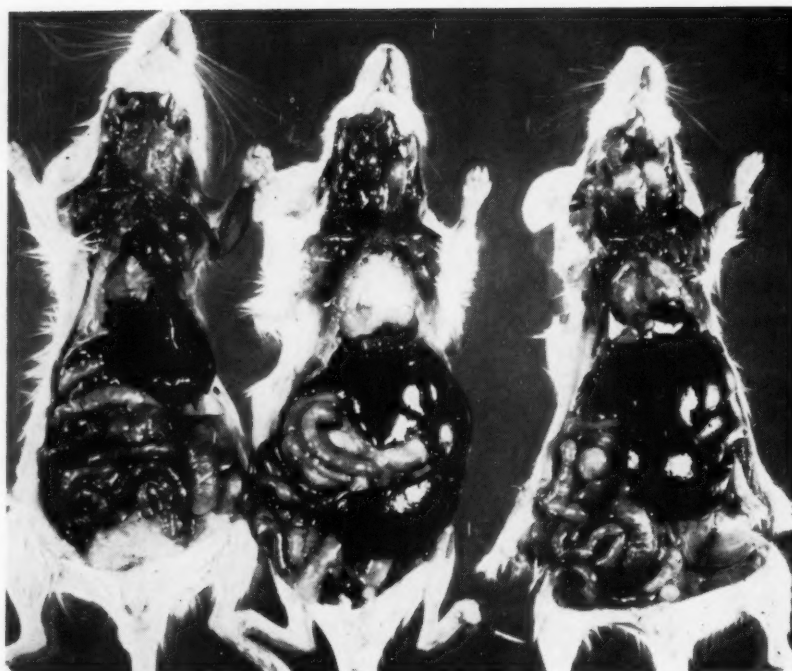
Stewart and Eddy have also shown that the polyoma virus has the unusual ability to cross animal strain and species barriers, for, although a mouse virus, it produces tumors in hamsters and rats as well.

A study conducted at the Sloan-Kettering Institute for Cancer Research in New York City about 3 years ago shed new light on the virus-tumor relationship in animal leukemia. Dr. Charlotte Friend reported her discovery of a virus that induced a leukemia-like disease in adult as well as infant mice within 2 to 3 weeks after inoculation.

Dr. Joseph Beard, the eminent virologist at Duke University, has pointed out that the studies by Friend and Gross have "firmly established the principle of virus etiology of well-known examples of mammalian leukemia." And, he adds, "There now exists a considerable body of information which is not only compatible with the hypothesis of the viral etiology of human leukemia, but which provides a substantial and reasonable background for pursuing investigations in man" ("Nature of the Viruses of Avian Myeloblastosis and Erythroblastosis" in Proceedings of the Third National Cancer Conference).

Dr. Leon Dmochowski, who with the electron microscope photographed virus-like particles in a variety of mouse and chicken tumor tissues, has conducted some interesting studies on human leukemia. In a collaborative study at the University of Texas M. D. Anderson Hospital and Tumor Institute in Houston, Dr. Dmochowski reported seeing virus-like particles in a biopsy from an enlarged cervical lymph node of a patient with acute lymphatic leukemia. He also reported that cells in the lymph nodes had undergone a number of changes similar to cell changes in affected organs of mouse leukemia and chicken lymphoma-

Figure 4. Mice inoculated with the Moloney virus center at 64 days of age, and right at 48 days. Left, a control C strain mouse



tosis. Visceral lymphomatosis is a common malignancy of chickens, known to be caused by a virus.

A year ago, one of our scientists at the National Cancer Institute reported a discovery that is, I believe, a real landmark in virus-cancer research. It is a fascinating story, beginning with Dr. John Moloney's studies of the properties of Sarcoma 37, an experimental mouse tumor. In the course of his investigation Dr. Moloney prepared a cell-free extract of the tumor and injected it into healthy mice. The result was quite unexpected. Within 8 months, the animals developed a type of leukemia that is indistinguishable from spontaneous leukemia in mice.

Following this lead, Moloney prepared extracts from leukemic tissue of the mice that first developed the disease, and injected these extracts into mice. By repeating this process several times, he obtained an extract so virulent that it caused leukemia within 10 weeks in 100 percent of the mice injected on the first day of life.

The leukemia agent is a virus, and the electron microscope has revealed particles that may be the virus. Unlike other mouse leukemia viruses, the Moloney virus causes the disease in several different strains. It is also active

against adult as well as newborn animals. None of the mice inoculated with the virus has developed any form of cancer except leukemia (fig. 4).

Along with the numerous reports of new virus-caused animal tumors, there have been many discoveries, often seemingly unrelated, in research on virus and cell constituents, their modes of behavior, and other characteristics. Recently we have come to see that all these results are very likely pieces of the same large and intricate puzzle.

Avenues of Research

This realization has been greatly responsible for the acceleration and vitality of virus-cancer research today. At the same time, the present phase of research in this field presents a number of problems and obstacles that demand wise and careful attention. With this need in mind, 15 distinguished scientists met at the National Institutes of Health in September 1958 to explore new approaches in virology and other sciences that might lead to major advances in human cancer. The group made four proposals: (a) basic study of viruses and animals, using electron microscopy and available animal tumors as models; (b) greater emphasis on

training of biologists, zoologists, and chemists in the basic medical sciences related to virus-cancer research; (c) improvement of sources and distribution among laboratories of living host and viral materials; and (d) expanded financial support to include large-scale interdisciplinary explorations over long periods of time. These are excellent suggestions, and most of them have already been acted upon.

Additional conferences were held in November 1959 and in March 1960 to further explore the problems of research on viruses and human cancer. These meetings were attended by many of the Nation's leading virologists.

Establishing the role of viruses in human cancer might seem a simple matter of finding virus in malignant tissue and then demonstrating that it caused the disease. However, there is a fundamental difficulty here: at the present time we have no way to demonstrate the carcinogenic effect of viruses on humans. We must, therefore, develop laboratory techniques that will attack the problem indirectly.

A key tool in the development of such techniques will probably be tissue culture. The number of laboratories where human cells are being grown in tissue culture has greatly increased in recent years, thus facilitating the search for and study of viruses in human tissue. Research of this nature is making wider use of techniques such as treatment with X-ray or cortisone that permit human tissue to grow in experimental animals.

Other fundamental studies are equipping us with knowledge of the relationship between the host animal and the virus. Dr. Ray Bryan at the National Cancer Institute has conducted some revealing studies on the Rous sarcoma virus in chickens. He has shown that there is a quantitative relationship between the amount of virus inoculated and certain biological properties of the tumor such as size, length of time before the tumor develops, and length of time before it kills the animal. In other words, Bryan's work makes it possible to refute the old argument that a tumor cannot have been caused by a virus if the virus cannot be extracted.

One of the principal questions that must be answered is, how do viruses enter a cell and make it cancerous? For many scientists, studies on nucleic acids offer the most promise

in this area. In cells the nucleic acid DNA is localized in the chromosomes, which carry the genetic information of cells and determine their form and function. Cells also contain another form of nucleic acid, RNA, most of which is in the cytoplasm.

Viruses are known to consist largely of nucleic acid, either RNA or DNA, and protein. But until fairly recently it was not known whether nucleic acid alone could be responsible for virus activity. Then, almost simultaneously, Dr. Heinz Fraenkel-Conrat at the Berkeley Virus Laboratory and Dr. A. Gierer and Dr. G. Schramm in Germany found that the RNA of the tobacco mosaic virus showed infectious activity.

This work pointed up the vital role of nucleic acid in virus activity, and of course, the possible role of nucleic acid in cancer.

In January 1960, scientists at Sloan-Kettering and the National Institutes of Health reported that DNA has been isolated from the polyoma virus discovered by Stewart and Eddy. Cancer was produced in laboratory animals by inoculating them with tissue culture fluids in which the isolated viral DNA was carried. This strongly indicates that DNA can enter a living cell and change the DNA of the cell to make it cancerous.

Such work has breathtaking implications, and it acts as a powerful stimulus to the scientific imagination. Studies on bacteria and bacterial viruses have shown that genetic material, and thereby hereditary traits, can be transferred by a virus from cell to cell, by a process known as transduction. This transfer might cause an abnormal, malignant change in the cell. Or, a viral nucleic acid might shed its protein coat and enter a cell, become incorporated into the genetic structure of the cell, and modify it so that the cell begins to reproduce abnormally. Bacteria studies also support the concept that latent viral nucleic acid in a cell might be activated by chemical or physical agents, and thus initiate malignant growth.

These possibilities and many others constitute a broad challenge to the scientific community as a whole. Intense, collaborative efforts in many disciplines, genetics, cellular biology, chemistry, immunology, to cite just a few, are needed. The National Cancer Institute is en-

couraging such activities through a greatly expanded program of grant support for virus-cancer research. Some of the investigators participating in this program are virus experts entering the cancer field for the first time. Emphasis is on the long-term support of the scientist himself, as opposed to support of a specific project, and support of some of our grantees in this field has been recommended for periods up to 10 years. I believe that these practices, which were recommended by our advisers, will help to insure the most productive work possible in virus-cancer research.

If viruses do cause cancer in man, and if these viruses are isolated, what then? How will we apply our knowledge to help save lives?

Prevention

Naturally, prevention is what we look to as an end result of all cancer research. There has been some success in developing vaccines against virus-caused cancer in animals. Stewart and Eddy have devised a procedure that immunizes hamsters against polyoma virus. Friend has developed a formalin-killed vaccine that protects mice challenged with live leukemia virus. And successful vaccines against visceral lymphomatosis in chickens have been developed by Dr. Ben Burmester of the Department of Agriculture's Poultry Research Laboratory in Michigan. On the other hand, attempts to detect antibodies against the Moloney virus have been unsuccessful, and have therefore hindered work on the development of a vaccine from this virus. This illustrates an important point: the isolation and identification of a cancer-producing virus may not lead to the speedy development of a vaccine.

Some day, it may be possible to produce a vaccine that will prevent cancer from developing in man. It might, of course, take years to determine its effectiveness, unless a vaccine for acute leukemia were developed. In that case, the effect of a vaccine given to babies would soon be obvious, since acute leukemia most often strikes young children.

If human cancer is a virus disease, another approach might be the use of drugs designed to destroy the virus either before it induced

cancer or very early in the course of the disease. Laboratory studies of a virus that infects bacteria have shown that selective action by such drugs is possible. The virus studied induces the formation of a particular enzyme necessary for the reproduction of the virus within the cell. A powerful anticancer agent, 5-fluorouracil deoxyriboside, will seek out this enzyme, which is only in the bacteria infected by virus, combine with it, and thus block the reproduction process.

Some intriguing studies of cancer treatment in humans have shown that infection of cancer cells with certain viruses destroys some of the cells. The effect is temporary, since the patient soon develops antibodies against the virus. In further studies, attempts are being made to inhibit the host's production of antibodies against these viruses, to develop methods of reaching the cancer with sufficiently powerful doses before antibodies develop, and to produce tumor-destroying properties in other human viruses.

Virus-cancer research has come a long way in the past 50 years. And the efforts of dedicated scientists in countries all over the world assure us that our knowledge of this complex field will steadily increase. This is indeed an era in which we are continually having to re-evaluate and readjust our concepts. It is difficult to imagine what new findings may be just beyond today's horizon. But I am sure it is no mere dream that research on viruses and cancer may eventually give us valuable new knowledge and skill that will help to prevent or arrest the development of many human cancers.

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Experiment in Enthusiasm

DURWARD L. BLAKEY, M.D., M.P.H., RAYMOND HOFSTRA, M.D., M.P.H.,
ESTHER GILBERTSON, R.N., M.A., and JEWELL G. WYMAN, M.A.

SEVEN years ago there were 1,712 unhospitalized people in Mississippi with known active tuberculosis, 90 percent of whom were not receiving any sort of care; and there were 783 beds for tuberculosis patients, 777 of them occupied. New cases were being discovered every day. Four years later this backlog of cases had been cleared up, and by 1956 nearly 85 percent of the newly reported cases were being treated. How was this done?

"By building more tuberculosis hospital facilities," probably would be the answer of people familiar with tuberculosis control and the recommendations for hospitalization.

But there was one big difficulty. Among the 48 States in the Union at that time, Mississippi ranked 48th in both per capita and spendable family income. Obviously, this solution was out.

Although there were in existence drugs that were successful in treating tuberculosis, their cost and difficulty of administration made any sort of mass approach impractical. Then isoniazid came along and a successful formula was found: isoniazid, in combination with other drugs, and enthusiasm, administered in equal parts.

With this formula, the Mississippi State Board of Health made a new approach to the

problem. A statewide outpatient drug therapy program was started for the large number of patients with active tuberculosis who could not be hospitalized. The organization of the State health department as well as the new drugs made such a "home treatment" program practical. Health departments in each county had X-ray facilities, and State laboratory services were available. The county health departments were supervised by the State board of health so that there was uniform administration, as well as comparable treatment. The State sanatorium was also under the direction of the board of health, making the coordination of home care with hospitalization easier. It goes without saying that no undertaking of such proportions could have succeeded without the wholehearted support of the workers in the county health departments and the cooperation of private physicians throughout the State.

The objectives of this program were simple: to protect the health of the community by reducing the sources of infection and to improve the health of patients through treatment. The program was not intended to replace other forms of care, and hospitalization was still recommended whenever practical. Both patients with active pulmonary disease and with primary tuberculosis were to receive drug therapy. After the program got underway, patients discharged from hospitals with recommendations for therapy, regardless of type of discharge, were also included.

The local health departments had the responsibility for making the program work. Whenever possible, treatment was to be provided either by or under the direction of the private physician of the patient's choice. How-

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ever, if needed, the health departments provided part or all of the necessary medical, nursing, drug, laboratory, and X-ray services, as well as instruction of patients.

The original policy statement of 1953 defined dosage and treatment regimens for streptomycin, PAS, and isoniazid, with all three drugs to be given simultaneously to every patient when at all possible. The necessity of bed rest and proper nutrition was stressed to patients entering the program. In 1956, the original policy statement was revised to include recommendations for length of treatment by form and extent of disease.

Because of the financial situation in the State, the board of health was unable to provide any additional funds for drugs when the program was started, and the local health departments were given the responsibility of getting the necessary money in whatever way they could. This was done. The local tuberculosis associations and county boards of supervisors proved to be major sources of funds. Civic and religious organizations and individual citizens also contributed. In spite of this informal approach, local health department staffs feel that no patient was denied drugs or had treatment delayed for lack of them.

Starting in 1954, the State board of health was able to distribute a limited amount of drugs to local health departments in proportion to the amount of local funds used in buying drugs for totally indigent patients.

Since the health departments purchased the drugs in large quantities, they were able to obtain them at reduced cost. Thus many patients found it possible to pay for their own drugs. Whenever practical, patients were encouraged to contribute something toward the cost, even though in many cases this amounted to little more than a token gesture. It helped ease the burden on the health departments, and they believe it had a good psychological effect on the patients, encouraging them to maintain treatment.

The health departments found it necessary to schedule regular hours for taking X-rays and giving streptomycin injections. Staffing these additional clinics, instruction of patients, and maintaining continuity of treatment was accomplished chiefly by the nurses. In 1955, re-

gional consultation clinics were established by the State board of health to aid county health departments and private physicians in diagnosis and treatment. Each health department had access to expert medical consultation at least once every 3 months. These clinics also encouraged better use of both the outpatient and inpatient facilities of the State sanatorium.

Evaluation of Accomplishments

In the early years of the home treatment program, the demands on everyone were so great that there was little attempt to evaluate progress. After 4 years of operation there was a growing recognition of the need for factual information, and in 1957 the Mississippi State Board of Health and the Tuberculosis Branch of the Public Health Service began a cooperative study of the program (1). The material discussed hereafter comes chiefly from this survey.

The study showed that the home care program was successful in achieving its primary aim, protection of the health of the community by bringing the large number of patients with active tuberculosis under treatment and thereby reducing sources of infection. When the statewide plan was put into effect in 1953, 25 counties had already started home treatment for tuberculosis patients. By the end of the first year of operation, 69 counties had entered the program, 9 more joined the next year, and by the end of 1955, every county in the State was participating.

The number of patients participating in the program showed a similar increase. In 1953, 630 patients were being treated; by 1956 the total had risen to 1,820. There was no serious difficulty in persuading patients to accept or continue treatment. Sixty-three percent started treatment within 1 week after recommendations, 83 percent within 1 month, and 95 percent within 6 months. At the time of the study, 82 percent were thought to be taking their drugs regularly. Only 8 percent discontinued drug therapy for as long as 2 months, and only 15 percent refused treatment or were lost to supervision after they started home treatment.

It was not possible to determine exactly how many of the 1,712 patients who were known to

have active tuberculosis in 1953 were treated under the program, nor to what extent cases newly reported in the following 2 years participated. However, 3,055 patients were taken care of during the 4½-year period between the beginning of the program and the 1957 study. If what happened in 1956 is any indication, and it is felt to be a good one, then most of the people who needed treatment got it. In that year nearly two-thirds of the newly reported active cases began home treatment, and another 22 percent were handled by private physicians and hospitals. Since about 5 percent of the new cases that year were reported at the time of or after death, only about 15 percent had no treatment or treatment was unknown.

Fifty-four percent of all the patients treated during the 4½ years had far-advanced disease when starting home therapy, and another 29 percent were in the moderately advanced stage. A substantial portion of the patients of working age (27 percent) were working either full time or part time when they joined the program. The patients were grouped in the following ways:

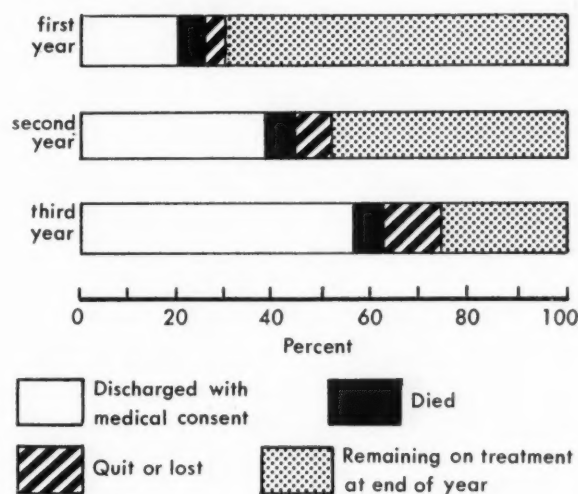
Characteristic	Percent
White	47
Nonwhite	53
Male	59
Female	41
25-64 years of age	71
All other ages	29

About one-fourth of the patients treated were discharged from the hospital to start home treatment and were not subsequently hospitalized. For obvious reasons, the medical characteristics of this group were quite different from those of the group who entered without hospitalization, both at the beginning of home treatment and at the time of the study.

Nearly 90 percent of the people who started treatment without hospitalization had active tuberculosis, and 60 percent had positive sputum. Among those who started treatment after leaving the hospital, 46 percent were active, 42 percent arrested, and 80 percent had negative sputum.

Reasons why patients stopped treatment during the 4½ years from the beginning of the

Figure 1. Distribution of patients at the end of successive years of treatment with drugs in Mississippi, 1953-56



NOTE: Discharged with medical consent includes patients who transferred to hospital, moved, or changed supervision.

program to the time of the study are given below:

	Program group (percent)	Hospital discharge group (percent)
Medical consent	29	63
Transferred to hospital	37	0
Moved or changed supervision	11	16
Refused or lost	14	17
Died	9	4
Total	100	100

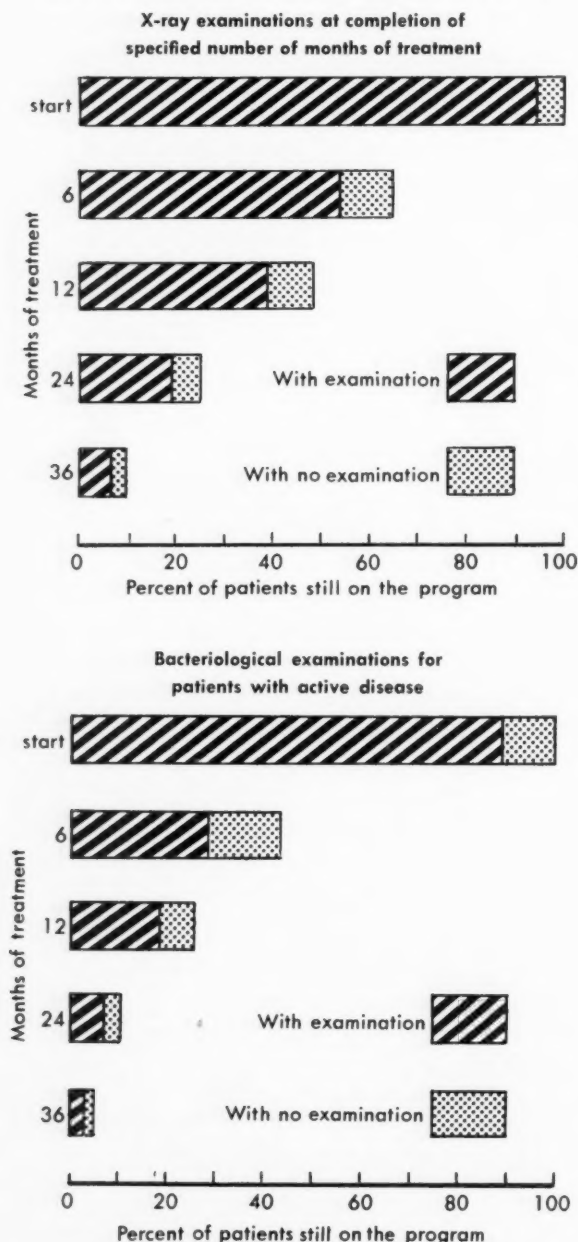
Since the patients who had some hospitalization were in better condition when they started home treatment, it is not surprising that 63 percent of this group were discharged with medical consent as no longer needing treatment. Only 29 percent of those who entered the program without prior care were so discharged. On the other hand, the fact that more than one-third of the latter group were hospitalized eventually indicates that ambulatory treatment in many cases cannot be expected to be an adequate substitute for hospitalization. As far as keeping patients under treatment was concerned, whether or not a patient had had any hospitalization did not seem to matter.

The persons who started home treatment without previous hospital care did not get well

overnight (fig. 1). However, after 3 years, 56 percent had been discharged with medical consent.

A group of newly reported active cases was studied in an effort to determine the therapeutic effectiveness of the program. The group

Figure 2. X-ray and bacteriological examinations of patients with active tuberculosis treated with drugs in Mississippi, 1953-56



NOTE: Patient was said to have had an examination, if examination was made within 3 months before or after date due.

was composed of patients with no previous medical care prior to starting treatment at home. All had at least 6 months of treatment, and some were hospitalized at some time during the 2 years they were studied. After 2 years of treatment, 62 percent were either arrested or inactive, 27 percent were still active and continuing treatment, and the remainder had stopped treatment before their disease status had changed. However, the patients still being treated showed improvement. Nearly three-fourths had positive bacteriology at the beginning; after 2 years only slightly more than one-fourth still had positive sputum and the percentage of patients with negative bacteriology increased from 18 to 51 percent. The increase from 10 to 22 in the percentage of patients with unknown bacteriological status still considered to be active probably resulted from the absence of sputum after 2 years of drug treatment and the refusal of some patients to supply specimens.

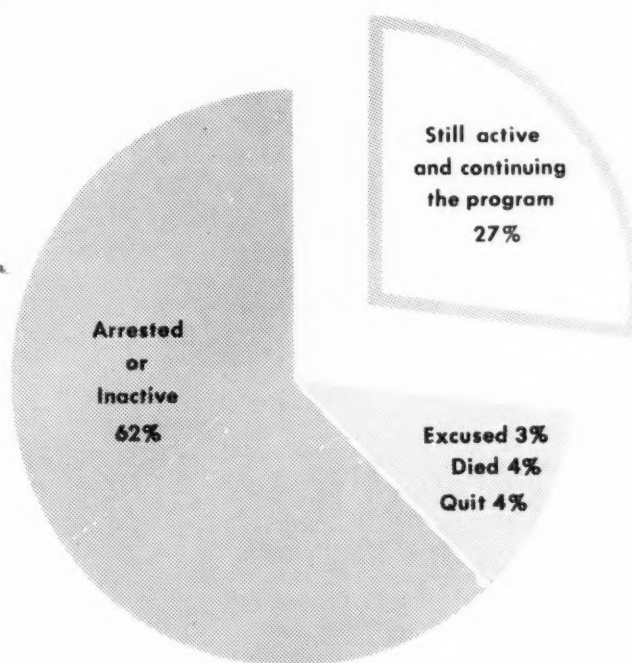
Flaws

Thus far the considerable accomplishments of the program have been presented. Successful as it proved to be, however, Mississippi started a crash program to meet an emergency situation and only the most confirmed optimist would not have expected some flaws to develop. In addition to the difficulties inherent in supervising patients at home, the study also revealed weaknesses in the program itself.

First of all, 13 percent of the patients started home care with an unknown bacteriological status. The sputum test was the only method used to make this determination. At the end of 3 years of program operation, there was still a significant proportion of the patients who were not receiving bacteriological and X-ray examinations at the proper intervals. These weaknesses are reflected in figure 2.

The development of a reservoir of patients with isoniazid-resistant organisms is a hazard in a program of this type. It was decided, however, that the main objective of the program, to lessen sources of infection, was of primary importance and the careful medical supervision of the dispensing of drugs would minimize this element of risk.

Nearly two-thirds of newly reported cases of active tuberculosis were either arrested or inactive after two years of combined home treatment and hospital care (about one-third were hospitalized for a time)



Even if complete data had been available on all patients on home care, their progress still would not have received proper evaluation. The job was simply too large for the two part-time consulting physicians to handle. In 1956, for example, the cases of only 60 percent of the patients on drug therapy were reviewed by the regional consultants.

Supervision also proved to be a problem. About 25 percent of the patients who started home care were working, even though they had active disease. At the time of the study, nearly 30 percent of the patients with positive sputum were working.

A most glaring need was for treatment under more controlled conditions for the patients who failed to make satisfactory progress. A significant portion of the patients (20 percent) failed to show a conversion in their bacteriological status after 6 months or more of treatment. Furthermore, a substantial portion (27 percent) still had active disease after 2 years of treatment.

Discussion

Two years have passed since the survey and steps have been taken to correct some of these

weaknesses. In the area of administration, the program has been tightened by making the director of the division of preventable disease control, under the general direction of the executive officer of the Mississippi State Board of Health, responsible for coordination of the home treatment program with the State sanatorium.

Currently, when any change in a patient's status occurs, the information is immediately reported to all the other agencies participating in his care, thus improving considerably the continuity of treatment. In addition, new patients or patients who have failed to make satisfactory progress without hospitalization can be quickly admitted to the sanatorium by the two chest specialists.

Although it has not been possible to increase the number of cases reviewed by these consultants at field evaluation conferences, their work has been made more productive through greater selectivity in the cases to be reviewed. Guides are also being developed which will help even more in this selection.

The 1957 study revealed that a number of patients entered the home treatment program with the extent of their disease, bacteriological status, or both, unknown. Today, patients are

no longer being started on treatment without a minimum diagnostic workup. Emphasis is being placed on the techniques of collecting sputum as well as on the need for three sputum examinations at the time of every X-ray, and the tuberculin test is being used routinely in establishing the diagnosis. In addition, the State health department no longer accepts new cases as "pulmonary tuberculosis" if the necessary reporting on extent of disease and bacteriological status is not included.

Procedures have been developed also to facilitate data collection at the end of each year on the number of patients treated, length of treatment, and clinical status. This annual evaluation provides the State board of health with the necessary information for more precise planning of its treatment program, whether in the hospital or on an ambulatory basis.

The Mississippi home treatment program was started in 1952 because it was impossible to give

hospital care to many people who needed it. Now the day is not too far distant when every newly discovered case of tuberculosis in the State can be hospitalized first, and then, once they are on the way to recovery, released to continue treatment at home. When compared to some areas of the United States, this will be regarded as nothing unique, just good tuberculosis control. But the people in Mississippi who had to face the dismaying facts in 1952 know that this accomplishment in tuberculosis control could not even be mentioned today if it were not for the State experiment in enthusiasm.

REFERENCE

- (1) U.S. Public Health Service, Tuberculosis Program: Evaluation of the Mississippi program of home treatment for tuberculosis. Mississippi State Board of Health (distributors), Jackson, March 1959, 23 pp.

Courses in Care of Premature Infants

In the fall of 1960, the Institutes for Physicians and Nurses in the Care of Premature Infants at the New York Hospital-Cornell Medical Center, under the sponsorship of the New York State Department of Health and the Children's Bureau, will begin their 12th year of operation. These institutes are designed to meet the needs of physicians and nurses in charge of hospital premature nurseries and special premature centers, and of medical and nursing directors and consultants in State and local premature programs. The attendance at each institute is limited to six physician-nurse teams. The program for physicians is of 2 weeks duration and that for nurses of 4 weeks duration. Participants pay no tuition fee and stipends are provided to help cover expenses during attendance at the institutes. Institutes for the 1960-61 year are definitely scheduled to start on the following dates: September 19, 1960; November 28, 1960; January 23, 1961; March 13, 1961; May 8, 1961. Early application for these institutes is essential since plans are contingent on the number of applications received.

Additional information may be obtained by writing Box 143, Institutes in the Care of Premature Infants, the New York Hospital, 525 East 68th Street, New York 21, N.Y.

X-Ray Protection Techniques

WALTER R. STAHL, M.D.

Oregon's radiation law, effective July 1, 1957, authorized a 2-year study of radiation exposure before promulgation of regulations and standards, discussed in a previous paper (PUBLIC HEALTH REPORTS, April 1960, pp. 331-336). The first phase was a survey of diagnostic X-ray units, which not only provided information on conditions in the State but also afforded an opportunity to offer suggestions for improvement in equipment and techniques. On the basis of inspections of several hundred units, supplemented by appropriate literature references, this paper discusses technical aspects of the survey, emphasizing methods for reducing exposure of personnel and patients. The results and their interpretation will be reported in a later paper.

THE chief of a radiological health program is continually called on to interpret the "real" biological hazard of a given exposure, the probabilities of delayed effects after certain radiation doses, reasonableness of a particular procedure from the radiological viewpoint, or significance of a given shortcoming in a specific X-ray unit. He must be able also to interpret various aspects of radiological safety practice based on, but not fully covered by, recognized standards. Good concise background material on these questions has been published (1-3).

Meeting such demands requires extensive training in the entire field of radiological health. Preferably, the chief should have a degree in medicine plus perhaps 1 year of residency in radiology or a postgraduate year in radiological health. However, with sufficient personal effort, individuals with other back-

grounds may be able to assume the responsibilities.

Suitable short-course and long-term training is offered by the Division of Radiological Health of the Public Health Service. The Atomic Energy Commission also offers courses in radiological health, but so far these have dealt primarily with the control of the potential hazards of radioisotopes.

With a well-trained chief, the other personnel in an X-ray radiation safety program can have variable backgrounds and training. Particularly valuable is prior experience as an X-ray technician. In general, however, anyone with the approximate equivalent of a bachelor of science degree can be trained to survey X-ray units. Experience in reading instruments is helpful, as is some acquaintance with medical terminology.

The program chief may train his own personnel, regardless of background, so that the proper standards are applied in fieldwork. An orientation period of about 2 to 6 months is not unusual, with frequent group training in the field on X-ray units. The staff should be supplied also with suitable reading materials, such as glossaries of medical-radiological terms, manuals of radiographic techniques (4), and the materials of the National Committee on Radiation Protection (which are published as National Bureau of Standards handbooks, available from the U.S. Government Printing Office).

Inspection Forms

Making complex value judgments concerning X-ray units in the field may be somewhat easier by the use of standard recording and recom-

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mentation forms. Ideally, these should be based on practical experience of several months duration. They should be concise and allow "checkoff" whenever feasible. Coding for future tabulation should be included. Suitable forms have been developed by the Division of Radiological Health, Public Health Service.

Oregon finds it practical to use such forms for on-the-spot reports of the inspections. They can be filled out in carbon duplicate, with a ballpoint pen or typewriter, the original given to the practitioner and the carbon copy retained for the office file. Although it might be charged that such reports are not written by experts, we believe that the advantages outweigh this disadvantage. First, they permit suggestions and recommendations to be given immediately to the practitioner. Second, the radiation expert back in the office usually does not have time to go over the field reports in sufficient detail to insure that his judgment of the situation will be better than that of the person on the spot. Third, writing of reports in the office cuts down efficiency of the fieldwork. Sound training in radiation principles for the fieldworkers and the use of standard forms with checkoff items prepared by an expert are key factors in this process.

The use of checkoff forms not only saves much time but also permits more detailed and uniform recommendations. Writing complete recommendations on any given X-ray unit could be an extensive undertaking. Merely putting down that "adequate coning should be provided," for instance, is almost worthless from the practical viewpoint. Details are needed on how to choose cones, the possible use of an adjustable cone, and so on. The use of a checkoff recommendation sheet does not, of course, replace individual verbal explanations on each important item during the office visit. Also, space may be used on the form for items not covered in the printed schedule. A face sheet summarizing the major inadequacies noted, degree of cooperation, and need for a revisit is useful.

The Approach

Before fieldwork is begun, letters to X-ray machine owners describing the program and,

preferably, expressing the endorsement of the appropriate professional society are useful. This step was taken in Oregon, and each user, not his secretary or nurse, was also called on the telephone and asked for a specific appointment. Time was taken to explain concisely the goals of the program, always with the attitude that the practitioner is a professional person who wishes to fulfill his responsibility in regard to radiation hazards. Our experience demonstrated that, when approached in this manner, the vast majority of practitioners will agree to a review of their X-ray units.

Endorsement of the program by the medical leaders in the community is important in obtaining active cooperation of the practitioners. The policy in Oregon has been to visit first the radiologists and larger hospitals. Grapevine information about the X-ray surveys is always widespread and can be helpful or harmful.

If possible, appointments for visits should be scheduled several days in advance to allow flexibility in regard to crowded practice hours, afternoons off, or prior commitments. A field staff of four needs perhaps half a day in a community for, say, 12 to 16 surveys. Using forms, we have found it possible to complete an inspection and report in an hour.

The typical medical or dental practitioner or veterinarian has had little formal training in taking and processing X-rays. Usually he has acquired his knowledge through experience, based perhaps on instructions supplied by X-ray distributors. Such instructions may or may not consider protection from radiation. X-ray technicians vary greatly in training and experience. Registered technicians usually have had hospital radiology department training and understand their work quite well, but even they should not be expected to know, for example, the implications of underdevelopment of films or increased kilovoltage in relation to exposure. The usual technician is office-trained by the physician and X-ray distributor, and many of them rely on prepared charts of exposure without understanding basic principles.

We have prepared a clearly written statement of the essentials of radiological protection which is left with each practitioner (in addition to the checked recommendation form), and explanations are provided while the standard

form is being filled out. In addition, the X-ray safety program includes lectures at meetings of practitioners of various types. The practitioners are encouraged to read the available literature, such as the booklet on X-ray protection by the American College of Radiology (5).

Specific technical problems encountered in X-ray survey work are discussed in the remainder of the paper. References to the literature, of course, represent only a sampling of the many excellent articles of recent years. It should be noted, however, that a number of these articles were written by radiologists. Their standards are not always applicable, from a practical standpoint, to general medical or dental offices.

Film Badge Monitoring

The Oregon survey revealed few instances of gross overexposure for operating personnel. This finding is consistent with reports of other surveys (6-8). Positive documentation and recording of doses by means of film badges, however, were infrequent.

The Oregon State Board of Health recommends film badge monitoring for all radiation users, although for small caseloads monitoring need not be continuous. At an approximate cost of \$1.50 per badge (for small quantities), the use of badges on two or three potentially exposed personnel for a month each year, for example, is not a major expense. Annual monitoring and special surveys whenever there is a significant change in equipment or caseload are recommended for the usual small X-ray installation.

The field personnel should be familiar with the so-called dental film monitoring method, which has been widely used, but certainly does not replace film badges. A paper clip is affixed to a plain dental film, which is carried in a pocket for a week or two and then developed. An outline of the paper clip, which appears at an estimated 25- to 40-mr exposure, is considered a positive result. Monitoring with dental films or film badges on walls, however, has little value for indicating exposure of personnel.

Pocket ionization chambers, encountered occasionally in hospitals, are useful as a supple-

ment to film badge monitoring. They tend to read low because of the softness of scattered secondary X-rays, and recording of the doses must be systematic and evaluated with caution.

For definitive advice on personnel protection, the best resource is familiarity with the standards for occupational exposure formulated by the National Committee on Radiation Protection, and published in the National Bureau of Standards Handbook No. 69. The permissible radiation is different for various parts of the body—hands, neck, lenses of the eyes, and gonads—and for the whole body, to be applied as appropriate.

The recent revision of occupational exposure limits abolished a specific weekly whole-body or gonadal exposure limit in favor of 3-month, annual, and cumulative limits. For surveillance purposes, however, the weekly maximum is 100 mr for continuing occupational exposure. The quarterly limit is 3 r and the annual limit is 12 r, but cumulative exposure is not to exceed the number of roentgens arrived at by multiplying age, less 18, by 5. Even moderately good protection leads to weekly exposures much below these limits, on the order of 25 mr per week (6,7).

Since 3 months is the shortest period for which a limit is now given and since the cumulative limit has been lowered, some film badge processors offer a double film badge: one packet to be replaced every 2 weeks and the other to be worn for 3 months. Use of this badge, which minimizes the recording of "fog" as actual exposure to radiation, seems desirable when prior exposure records are accurate and close to limits. As an alternative, wearing a single film badge for a month instead of 2 weeks would seem reasonable in most instances.

The Oregon Board of Health has not undertaken to supply film badges as part of its survey because of the expense and also because of a feeling that badges would be used more consistently if paid for by the X-ray unit owners. Further, the practitioner will have to make contact with a film badge distributor sooner or later, and the occasion of a survey is a good opportunity.

Film badges appear to be much more reliable than survey instruments for most personnel monitoring, although instruments are useful in

surveying fluoroscopes. The standard kit of instruments used by the Oregon Health Department, shown in figure 1, consists of a "cutie pie" ionization dose rate instrument and a condenser r meter. The instruments should be checked for accuracy in the energy region of soft X-rays before a final choice is made.

Personnel Protection Devices

In offices with small caseloads, special personnel protection devices may not be necessary, depending on attenuation by the tube head, design of the office, and work habits of the technician. Exposure should be documented in all instances, however. We usually suggest some sort of protective device to reassure the technician and provide legal protection for the owner, but on this question, as on others, judgment as to the hazards is a ruling factor. Rigid application of protection rules without consideration of the particular situation may lead to unnecessary difficulties.

In offices with a normal to heavy workload, a leaded barrier is recommended. It need not be expensive, since a lead sheet or lead-faced plywood can be purchased and installed by the owner (9). The field staff can easily learn where such materials are available locally, how much they cost, and how to install them. (This information should also be provided in the notes given each X-ray owner.)

Enclosed leaded cubicles are hardly ever mandatory in diagnostic work, although they are often found today in the larger hospitals. With adequate structural material in the walls, experience indicates that lead shielding in the walls of the radiographic room is needed only if there is an exceptionally heavy workload and permanent occupancy in adjacent rooms. However, lead is often needed behind the cassette holder used for chest and upright X-rays if the beam points into the waiting room or other occupied areas. Outside brick walls or distance often reduce the radiation exposure in the vicinity to small proportions. However, any possible exposure, including that in adjacent offices of the same building, should be documented.

Exposure of the practitioner himself may pose special problems. There are still some



Figure 1. X-ray survey kit used by the Oregon Health Department

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| 1. Charging and reading unit for air-equivalent wall ionization chambers. | 4. Air-equivalent wall chambers. |
| 2. Ruled fluorescent grid for determining dental X-ray beam size and symmetry. | 5. Aluminum sheet for half-value layer determinations. |
| 3. Ionization dose rate instrument. | 6. Flashlight. |
| | 7. Tape measure. |
| | 8. Stapler. |

physicians who do not wear lead aprons and gloves in fluoroscopy or who use excessively old or cracked aprons. Small cracks or holes in aprons are not usually important, but, of course, they should be avoided when feasible. A recent review by Hale (10) discusses other fluoroscope monitoring problems. X-ray work in operating rooms, especially in genitourinary surgery, may lead to exposure because the surgeon, normally in a sterile gown, is reluctant to go behind shielding, even if it is present. However, most such exposures are limited and the hazard is not large, provided the physician stays away from the primary X-ray beam. A film badge check of all operating room personnel is advised if such work is at all usual.

Since radiographic exposures occur in short pulses of comparatively high readings (in milliroentgens per hour), it is usually not practical to assess resulting hazards with a survey meter. We especially discourage any such time-consuming procedures as plotting isodose curves near a unit. Past experience allows one to judge protection with considerable accuracy, and, of course, film badges must provide the final proof. Since reports are written at once, we rely on past experience in making recommendations without waiting for the results of film badge surveys. If there is doubt as to what the film badges will show, we write several alternative recommendations with instructions on how to interpret the film badge results, and usually schedule a revisit.

During surveys of fluoroscopes, we record the dose rate through the leaded viewing screen and at waist height near the unit. Values in excess of about 20 mr per hour for the former and 1,000 mr per hour for the latter may require special attention if the workload in minutes of fluoroscopic viewing per week is sufficiently high. Most readings observed in Oregon, as well as those reported in the literature (11), have been below these values.

Dental X-ray units may pose some difficult problems in personnel protection. Because of space limitations and a desire to watch the patient during X-ray, many dentists consider protective shielding awkward. For small case-loads, not more than 10 to 20 dental X-rays a week, experience indicates that a long timer cord on the unit, allowing the technician to stand 7 to 10 feet away, may be adequate protection, provided there is a good tube head and careful use. A recent report shows that dental exposure rarely exceeds 300 mr per week even in offices with minimal or no protection (8). An adjacent thick plaster wall which usually provides an attenuation factor of 2 to 6, may serve as shielding. Much depends on the design of the X-ray unit.

For heavier workloads, we recommend installation of a shielding device. Special attention is given to making this convenient. A hinged, leaded plywood sheet may be attached to a wall, for example, or shielding may be built onto an existing partition. Few dentists today hold films in their hands during exposure, although

cases of chronic radiodermatitis have been seen as the result of such practices in the past. For dental X-ray units, as for all others, the personnel exposure should be documented, and the suggestions made should take cognizance of individual needs.

Patient Exposure Reduction

Personnel exposure and patient exposure present quite different protective demands, and the distinction should be pointed out during surveys. Since one is often called on to discuss possible hazards of radiation exposure, all individuals conducting the survey should receive instruction on such subjects as genetic damage, leukemia, skin burns, and damage to embryos during pregnancy. Many moderate, carefully documented statements on these subjects are available (3,5). The information given to practitioners and technicians must be based on sound facts if confidence in the program is to be established.

Regardless of what specific conclusions are reached regarding the hazards mentioned above, and we feel the hazards should be put into the reasonable context of the numerous health hazards encountered in everyday living, one can state without equivocation that the changes the Oregon Board of Health recommends reduce patient exposures associated with needed X-rays by some 50 to 95 percent without sacrifice of X-ray quality. If this is understood, one need not argue about the possible deleterious effects of a given exposure or make the avoidance of X-rays a prime recommendation. Any substantial likelihood of harm justifies using the necessary protection techniques if they do not interfere with the advantageous use of X-ray. The Oregon program does, of course, try to discourage unnecessary or unusually hazardous procedures, such as spino-grams, shoe-fitting X-ray, well-baby fluoroscopy, routine pelvimetry in pregnant women, and routine examinations that cause heavy gonadal exposure, such as pre-employment examinations of the lower back.

Present standards for total population exposure to radiation are based on genetic considerations. In other words, genetic damage is thought to be the major limiting factor to

the use of radiation. Exposure of parts of the body other than the gonads may present some hazard in regard to leukemia, for example, but it is not thought at present to be a major consideration in ordinary diagnostic work. An exception is exposure of the fetus during pregnancy. There is some evidence that exposures of pregnant women to radiation may lead to an increased incidence of leukemia in the offspring and also that the mammalian embryonic nervous system is sensitive to radiation (2). It seems prudent to avoid radiography involving the abdomen of pregnant women that is not urgently needed. Some obstetricians estimate that not more than 5 percent of pregnant women need an abdominal radiograph.

Coning and Local Shielding

To prevent genetic defects produced by radiation, primary attention is given to protecting gonads from the direct beam whenever possible. Coning of the X-ray beam and gonadal shielding are the two main techniques for this purpose, and both present complex problems.

In principle, "coning" of the X-ray beam can provide good gonadal protection. Various devices are in use for confining the beam, the commonest being a metal cone attached to the tube head. Frequently, a cone of a single size is used for X-raying small fields, such as the gall bladder or sinuses, but no provision is made for limiting beam size when larger fields must be exposed. Another device in use is a lead diaphragm fitted into the tube housing. Sets of such diaphragms cut to required sizes for various fields are available in some localities. Cones and diaphragms, to be effective, have to be accurately tailored to the particular X-ray head and field sizes and used appropriately. A single cone or diaphragm cannot provide adequate protection. As a minimum, two different cones are needed for 14-inch by 17-inch films at 72 inches and 36 inches, and an additional narrow cone must be used for small fields. However, the narrow cone, known as a "sinus" cone, may also happen to suffice for 14-inch by 17-inch fields at 72 inches. The surveyor must have a clear mental picture of the geometry of X-rays and needs to know how to locate the position of the anode on the tube housing

(usually indicated by a red spot). We usually carry a small slide rule to facilitate computations.

The following are examples of situations we have encountered in connection with beam collimation. Two or three cones are present but all are too large for the field sizes used. Cones are present, but the technician does not use them. The practitioner is willing to get one or two more cones, but the correct sizes are not commercially available. The practitioner is reluctant to spend some \$20 apiece for new cones. There is little use of available diaphragms, although sets of four or more may be on hand, labeled according to field size and use.

A more fundamental problem is that properly chosen cones allow little margin, and poor centering of the machine leads to cutoffs on films, producing some annoyance and a need for retakes. Although many radiologists may not object to slightly cut corners, others are unwilling to accept them, with the result that the cones are not used.

A variable aperture collimator offers a way out of this difficulty. Essentially, a variable aperture collimator is a continuously adjustable round or rectangular lead diaphragm, which can be set conveniently for any given field size and distance combination. A centering light or light beam is provided to facilitate positioning. A small model sells for about \$100, and better units up to \$450. We have recommended purchase of variable aperture collimators when it appeared that the practitioner would be interested. However, even adjustable collimators pose some difficulties. They must be precisely attached to the tube housing in order to produce a symmetrically centered field. Put on carelessly, they can also cause cutoffs, which force the technician to set them at a somewhat larger field size than indicated, to that extent decreasing their protective functions. Also, some of these collimators have a built-in extra beam size margin of 1 to 2 inches in all directions, which is probably necessary if one aligns with a central light spot. Several adjustable cones have been manufactured that project the entire field rather than one central spot. They should be very satisfactory, provided the light and X-ray beams are accurately centered with respect to each other.

The radiation-safety aspects of an ordinary P-A chest X-ray illustrates these problems further. One would hope to limit the beam sufficiently to protect the ovaries in the female. If a round metal cone is used, it must be checked first for proper size, using the diagonal measurement of the 14-inch by 17-inch film and about a 2-inch margin in each direction to give a final diameter of roughly 24 to 25 inches. In order to get an accurate field, the cone itself must be tailored to less than one-fourth inch in critical diameter. The necessary wide choice of cones is not usually available. If a circular field is used, its lowest portion will extend well down into the gonadal area of a woman, though the male gonads would be excluded. Rectangular cones (nonadjustable) are not widely available at present. If diaphragms are used (most machines are not equipped for them), the utmost precision is required in computing and cutting out the apertures. Because of lack of standardization on units of different ages and manufacturers, diaphragms must be practically tailor-made for the unit. If a variable aperture collimator is used, it must not allow excessive margins, and it must be accurately centered.

These complications are mentioned because it should be well understood by the field staff that the mere presence of one or even four cones does not assure good coning.

Accurate coning, of course, is more important in certain projections than others. For a film of the foot or ankle, almost any cone will protect the reproductive organs from the primary beam. In abdominal or lower back X-rays, it is difficult with cones alone to exclude the gonads from the beam.

Because of the practical difficulties in achieving adequate coning, we recommend gonadal shielding as a supplement to coning. Considerable overt resistance to local shielding has been encountered in the field. Some practitioners (and technicians) feel it will alarm patients. Local shielding may be a nuisance. For upright projections, as of the chest, rather cumbersome aprons or externally supported shields are sometimes necessary. A variety of gonadal shields are on the market, including leaded bivalved arrangements for the scrotum, but these involve hygienic and aesthetic considerations.

With radiography of the abdomen, the pelvis, the hips, or the lower spine, considerable care and ingenuity are needed if protection of the gonads is to be achieved by shielding. Various shaped pieces of lead are needed, for example, for protection of the ovaries during abdominal work, shielding of the scrotum or ovaries in infants being checked for congenital dislocations of the hips, or protection of the ovaries and fetal gonads during pelvimetry. Shields made of leaded glass woven material can be used but are low in lead equivalence and are expensive. Descriptions of specialized shielding devices are found in the literature (12-14), and one's imagination is the only limitation for suggesting new arrangements. For routine chest X-rays externally supported shielding is probably necessary if large round cones are used. Few X-ray users surveyed in Oregon have taken the steps necessary to curtail gonadal exposure in examinations of the critical lower trunk area. A useful technique for local shielding is the mounting of lead sheet on a larger clear plastic sheet, which can be positioned over the patient accurately and easily.

In photofluorographic (p.f.g.) work (in chest X-ray vans, for example) limitation of beam size is often more nearly satisfactory because precise diaphragms can be cut and permanently installed. We advise checking the actual field size projected with X-ray films or fluorescent materials. Usually the film-carrying hood assembly is coupled automatically to the X-ray head. Therefore, no centering problem arises, and small margins are possible, especially on the bottom edge. For photofluorographic work improved lens systems, fast screens, and fast film help to reduce the dose. The film used in p.f.g. units differs in size from ordinary X-ray film and is not necessarily available in the same range of speeds.

Limitation of beam size for dental X-ray units can be readily accomplished. Most dental units, however, have unnecessarily large beams although there is a plastic pointer on the outside, and a lead washer may even be installed inside it. Standards for dental radiography have been discussed in several articles (15-18). A 2¾-inch field diameter at the patient's jaw is advised. A 16-inch tube-to-skin distance is preferable to reduce parallax errors, but 8

inches is much more commonly used. Restriction of beam size is easily achieved by inserting a heavy lead "washer" inside the plastic pointer cone, of a size calculated to produce the recommended field diameter. Such washers, together with filters, are becoming widely available commercially, or they can be fabricated at minimal expense. We do not feel additional local shielding is indicated for general dental work.

Added Filtration

Another step that reduces patient exposure is the insertion of an aluminum filter into the X-ray beam (19). The filter cuts out the soft component of the X-ray beam, which otherwise would irradiate the soft tissues closer to the X-ray tube but would not contribute significantly to the actual X-ray image on the film. Current standards require a total filtration of 2.5 mm. of aluminum equivalent on radiographic units. Most X-ray tubes have an inherent filtration of about 0.5 mm., and therefore only 2 mm. of aluminum need be added. Some tubes have a substantially higher inherent filtration, up to 1.5 mm. We use a table listing inherent filtration for various machines, but when in doubt the assumption of 0.5 mm. is unlikely to cause difficulty. Provided a unit is used at kilovoltages higher than about 70, no change in exposure is required on insertion of 2 mm. of added filter, even where none was used before. At lower kilovoltages some small increase in milliamperage and time of exposure may be necessary. Many dental units operate at 55 to 65 kv. and with these the addition of 2 mm. of aluminum may cut down output to a level where exposure time becomes excessive. The current NCRP recommendations for dental machines call for total filtration equivalent to 1.5 mm. of aluminum. Most new units include the required permanent filters.

Film and Film Development

Film, film development, and film cassettes are comparatively simple components of radiological control. The usual X-ray film cassette contains two intensifying screens, one on each side of the X-ray film. Only when very fine detail is required (as in certain bones) should

film be used without such screens. Therefore, the effective exposure speed depends both on the film emulsion and on the cassette screens.

In recent years films have been substantially improved and several excellent fast films are on the market. The price is perhaps 10 percent more than for standard-speed film, but this should not deter their use. The fastest films may show slightly less detail, and radiologists may not find them entirely satisfactory for critical work. However, they are adequate for many purposes and can be expected to decrease patient exposure by 30 to 40 percent.

Cassette screens have also been improved. A pair of 14-inch by 17-inch cassette screens cost about \$30, in part because of the high standards of uniformity that are needed to prevent the production of spurious shadows on the films. Replacement of screens in all 6 to 10 cassettes used in an office is therefore expensive. Installation of fast screens in only one cassette is possible in a small office, but then two different exposure techniques have to be used. The reduction of patient exposure with newer screens is about 30 percent. An optimum combination of screen and film promises even greater reductions, and specifically matched sets will doubtless become available soon.

Experience in the Oregon survey has revealed that a majority of X-ray films are not properly processed. In order to utilize the full speed of the emulsion the film must be fully developed, which means 5 minutes at 68° F. Some film manufacturers offer charts giving times for "standard" development and "full" development. There appears little question that 5 minutes can and should be allocated to developing the film, even in an emergency. However, as with any photographic emulsion, the temperature of the developer is a critical factor in the chemical process. Full development may be obtained at 75° F. in less than 3 minutes, but with some increase in grain size and fogging. Most smaller offices have no thermostatic baths, and many technicians control developer temperature by trial and error, using surrounding sink water with fair results. Others do not watch the temperature at all and control density by inspection, which is not desirable. Small electrical bath thermostats are not expensive

and ought to be recommended in practically all offices.

To produce a satisfactory film with a development time of only $2\frac{1}{2}$ to 3 minutes at 68° F. requires approximately a 50 percent increase in exposure. If full development, fast film, and other innovations are used, exposure time and milliamperage used in the tube, or both of these, may be decreased. Usually a multiplication factor for the combined changes can be established by trial and error for some representative exposure and then applied "across the board." It is possible at times simply to decrease exposure while obtaining good results, because X-ray film has some considerable exposure latitude.

Increasing Kilovoltage

A number of articles have appeared on the advantages of high kilovoltage in X-ray work (19-21). Simply put, the kilovoltage determines the velocity of each electron while the tube current (in milliamperes) is proportional to the number of photons per unit time. The total exposure is therefore measured in milliampere-seconds (MAS); it is proportional to the total number of photons reaching the patient. A change in tube kilovoltage has a complex effect, since it both increases the number and energy of photons. In practice a rule of thumb is that the MAS should be halved for each increase of 10 kilovolts. The advantage of higher kilovoltage is that the resulting beam is more uniform and penetrating. This increases the ratio of useful negative image to patient exposure.

Radiologists have generally considered high kilovoltage to be above 100 kilovolts. An objection has been raised that at values of 100-120 kilovolts the films have lower contrasts and are harder to read. However, radiologists who take time to get used to the "greyer" high-kilovoltage films find them completely satisfactory and often superior in range of detail. Most units in use, however, are not designed to operate at high kilovoltage. Some units may show a scale up to 110-120 kilovolts, but are not necessarily intended for heavy usage above 100 kilovolts, unless of recent design. For instance, the conventional high-voltage cables found on most

smaller units are said to fail rapidly at levels above 100 kilovolts. On the other hand, much work today is still done in the 60-75 range, which is less than satisfactory in producing a full range of detail. We recommend the use of the 75-90 kilovoltage range for the ordinary nonhospital installation, which affords a compromise between maximum reduction of patient exposure and practical demands.

When higher kilovoltage technique is adopted, the exposure charts must be extensively modified. Since modification is a complex undertaking, it is advisable to get a ready-made high-kilovoltage chart from an X-ray distributor. This can then be adapted to the given unit by a simple proportionality factor.

The radiological surveyor needs to know which distributors have charts and to study them himself so as to provide correct advice. Changing from 65 to 85 kilovolts results in substantial reductions in entrance skin exposures (by as much as 75 percent) with somewhat lesser reductions deep in the body.

Considerable time goes into explaining why higher kilovoltages are recommended since most technicians find this contrary to what they expect. Radiologists (and hospitals) commonly use medium-high kilovoltages and time and effort expended in encouraging them to go higher may be fruitful. Since radiologists are specialists in this field, some restraint is advisable in insisting that they alter their working technique. On the other hand, many of them have not given the high-kilovoltage technique a fair trial and may be encouraged to do so.

Since most dental units operate at a low, fixed kilovoltage in the order of 55-70 kilovolts, no major change in voltage is possible unless the unit is replaced. The newest dental units are adjustable and go up to 90 kilovolts.

The installations in use by chiropractors, osteopaths, veterinarians, and others are frequently, though not necessarily, old and of low maximum kilovoltage and current output. Replacement may often be advisable. However, it should be noted that kilovoltage is only one factor among many, such as filtration and film speed, and the vast majority of units in use can be put into acceptable condition though at lower than optimum kilovoltage.

We have encountered only a small number of really obsolete machines in Oregon, such as those with exposed wiring or bivalve tube shields without a full housing. These units are hazardous with respect to electrical shock alone. The surveyor should have a general idea of what new and good used X-ray machines cost and keep these figures in mind when discussing replacement. If replacement at a future date is decided upon, the practitioner nonetheless may still need to install protective items on his current equipment, since the purchase may be put off for years.

Dose Rate Measurements

A word may be said here about taking measurements of dose rate in the direct X-ray beam. We do not routinely measure dose rate in the X-ray beam except in fluoroscopic installations for the following reasons: many instruments do not read accurately with short pulses; making a full set of measurements with a condenser r meter is much too time consuming; and, most important, such measurements are really not needed to assure protection. The X-ray film itself serves as a final dosimeter for any exposure. Therefore, if a filter is present, if the kilovoltage is adequate, and if fast film is used and processed fully, the skin exposure for a given high-quality X-ray negative can be accurately predicted. While the output of machines at a given kilovoltage and milliamperage varies greatly when there is no filtration, much less unpredictability is found if the routine protective devices are present.

Many units in the field are of the convertible type, that is, the radiographic head swings under the table and is locked into position to produce a small fluoroscopic installation. For these, much information about the fluoroscopic output is already at hand after the standard inspection. Larger installations have separate fluoroscopes which require a separate survey. Frequently it is difficult to examine adequately the fluoroscopic tube head for filtration, and we therefore routinely obtain a half-value layer measurement as well as fluoroscopic dose rate in air. The half-value layer is that thickness of a given material which reduces the beam intensity by one-half. It is convenient

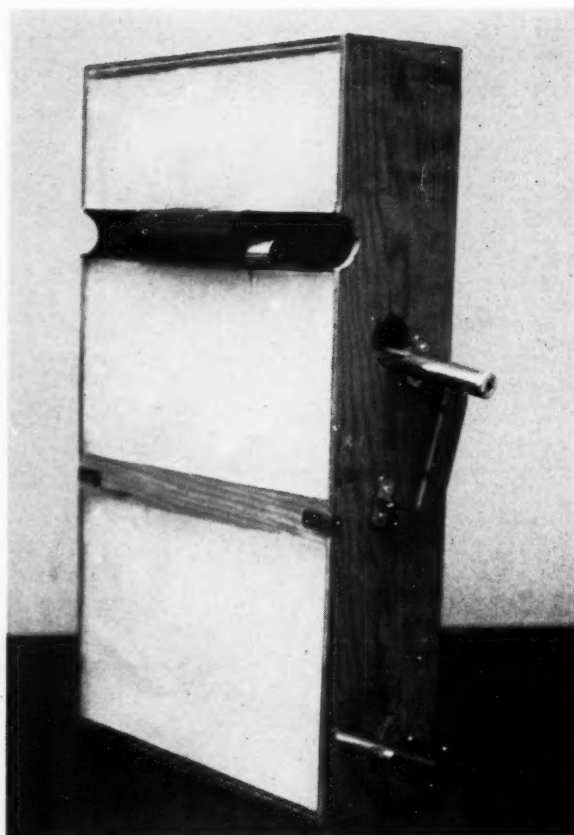


Figure 2. Paraffin phantom for measuring scatter radiation and depth dose

to use a 1 millimeter thickness of aluminum (pure, not alloyed) and take measurements with two suitable (5 and 10 r capacity) condenser r chambers simultaneously. Trout and associates (19) provide charts of the effective half-value layer equivalents of X-ray beams with a given kilovoltage and total filtration. Under ordinary conditions, 2.5 mm. of total tube filtration results in an X-ray beam that is further attenuated about 25 percent by an additional added millimeter of aluminum; that is, the measured dose in air and through the standard aluminum sheet (directly on the tabletop) should not differ by more than 25 percent. It is suggested that the proper values for a given instrument, filter standard, and so on, be checked empirically when a program is set up, using hospital units with a known total filtration. Somewhat more precise half-value layer measurements can be obtained with special metal caps over a condenser r chamber (10). Inaccuracies resulting from using the

chambers directly on the table rather than in a scattering medium are not very important in routine fieldwork.

Measurements of secondary radiation, however, should preferably be made with a scattering medium in the X-ray beam. Lateral dose rate at a fluoroscopic table is at least doubled by a scattering mass as large as the human body. A block of paraffin or stack of masonite sheets will serve this purpose. Measurements of semiresearch quality can be obtained by a standard paraffin block with openings at the surface and deeper channels for measurements equivalent to various depth doses. Figure 2 illustrates such a block. Aluminum sheet for half-value layer determination can be built into the block. It is then possible to get three or four useful measurements from a single exposure quickly and efficiently. If such a "phantom" is used for radiographic as well as fluoroscopic studies, special care should be taken to avoid saturating the chambers with excessively short and intense pulses of radiation.

Another basic fact concerning measurements is that even though the X-ray beam may be sharply limited by a cone, the secondary electronic equilibrium built up in any scattering mass, including the human body, extends appreciably beyond the original limits of the beam (22). Scatter measurements in a paraffin block taken, for example, 4 inches beyond what is thought to be the actual edge of the beam will be much higher than more distant scatter measurements. This point is also of importance in connection with recommendations about local shielding. For instance, any attempt to shield the ovaries with a pair of 2-inch diameter lead sheets on a plastic sheet would probably result in only a small decrease in actual radiation exposure of the ovaries because of the electronic equilibrium conditions built up deep in the body.

Special Techniques for Fluoroscopes

The present NCRP limit on fluoroscopic dose rate at the tabletop or panel is 10 r per minute in air (23). Judging by comments from local radiologists 5 r per minute is adequate for observations, and not infrequently 1 to 3 r per

minute may be practical. Milliamperage settings to achieve these dose rates run on the order of 1.5 to 3.5; but milliamperage meters are often inaccurate and should not be relied on. To fluoroscope successfully below 5 r per minute, 15 to 20 minutes of dark adaptation is recommended; even 10 minutes improves vision materially. Unless the fluoroscopic room is completely dark, light leaks may interfere with viewing. Red goggles for dark adaptation are owned by many but used by far too few. Low-efficiency screens used with some older fluoroscopic units should be replaced.

When the fluoroscopic viewing screen is examined for shutter adequacy, a dark margin should be found on the screen with the shutters wide open. However, this specification depends on the distance from the tabletop at which the screen is used, and judgment is therefore exercised in placing the screen for this test. Twelve to fifteen inches seems realistic, but perhaps a greater distance is safer. The residual dose rate through the leaded-glass fluoroscopic screen under normal conditions is commonly 5-20 mr per hour. Rates above this require investigation (10).

High rates may sometimes be due to a failure to readjust kilovoltage to the usual fluoroscopic kilovoltage; this, of course, also increases the dose rate in air. Several scatter measurements can be made in the vicinity of the unit, preferably with a scattering block in place. Rates at the sides of the unit are often 250 to 1,000 mr per hour, rising to as high as 1,500 mr per hour at certain locations above the table but not in the direct beam. While these values are high, it should be noted that few units are used for as much as an hour a week, except in hospitals, and also that the user is expected to be wearing protective garments. Some also employ lead hangers at the fluoroscopic assembly and to cover the Bucky slot. The fluoroscopist's forearms may be exposed to more than 300 mr a week, but this is below exposure limits for the hands and wrists of 1.5 r a week. Normally the shutters are at least partly closed during actual use. Film badges should be the court of final appeal. They should be used inside the apron and possibly on the collar and coat sleeves.

An additional NCRP specification for fluoro-

scopes is a minimum distance of 12 inches and a preferred distance of 18 inches from tube target to panel or tabletop. We have found that most units fall somewhere between these measures. The reason for this specification is rather complex, involving differences in effective dose rate at varying depths in the body, as influenced by the inverse square law. Some recent actual measurements suggest, however, that the dose at minimal distances is not too great (10), and we believe considered judgment, with cognizance of measured dose rate, should govern suggestions for rebuilding a unit. It should be clearly understood that the point at issue here is not simply dose rate as a function of distance, but a much more involved physical phenomenon.

Among various specialized types of fluoroscopic installations, a common one is the upright unit used by internists for quick inspections of the heart and lungs. Since the fluoroscopic unit does not tilt to the horizontal position, it is practical to tape up the chambers and half-value layer filter with wide adhesive tape. The controls on such units often show transformer primary (line) voltage rather than secondary voltage actually impressed on the X-ray tube, and it is therefore often impossible to assess operating kilovoltage. However, this is immaterial as long as dose rate and half-value layer are known and adequate.

Fluoroscopic units in pediatric clinics require careful scrutiny. It is easily possible to deliver as much as 10 r to the gonads and much of the body of an infant in a single fluoroscopy examination if the exposed field is not well collimated. If every infant received such a dose, the gonadal limit of 10 r for the total population by age 30 would be exceeded (1). Many authorities have strongly urged decreased use of pediatric fluoroscopes, and we have found it possible to persuade many physicians to agree, although a few pediatricians wish to have the unit available for emergency work, to locate foreign bodies, for example. If the unit is used, it is clear that low milliamperage and adequate filtration and shutters should be present for protection. In some instances a lead sheet (2½ pounds per square foot) with a small rectangular cutout somewhat smaller than the usual infant chest is permanently mounted on

the tabletop in place of shutters. Pediatric units unfortunately are frequently found to be converted X-ray units without shutters. The pediatricians always welcome information about the dose rate of a unit and a discussion of the current concepts of gonadal and other exposure limits.

Most osteopaths and chiropractors in Oregon disclaim substantial use of fluoroscopy. However, their units, usually those of the convertible type, are checked for fluoroscopic output. Some hospitals have portable units and use is made of a hand-held fluoroscope. These devices are rapidly disappearing, as their use is condemned today.

If a unit owned by a chiropractor is used for spinograms, special collimating diaphragms with a slot-shaped aperture and the use of special gonadal shielding will at least reduce the dose. Most of the chiropractic units we have encountered have been older units of small output. Under these conditions the exposures required for penetration of the spine and pelvis run into many seconds; further reduction of output by filtration may extend this time. Since chiropractic work involves X-raying thick parts with potentially high gonadal exposures, the burden of justification is on the prescriber. As noted above, the State considers the dose unnecessary and actively discourages the use of spinograms.

Summary and Conclusions

Highly trained personnel are sought for inspection of diagnostic X-ray units. This work requires considerable specialized knowledge of X-ray technique, radiation measurements, personnel exposure standards, and radiobiological effects. The chief of such a program has to answer questions relating to radiological hazards, and it is advisable for him to have formal postgraduate training in radiobiology. The working team requires specific field instruction under the guidance of the program chief.

Occupational X-ray exposure appears to be fairly well under control; few gross overexposures are found. Film badges are suggested wherever personnel monitoring is required, but not necessarily for use continuously. Experience is often more reliable for judging personnel exposures than survey instruments.

Collimation of the X-ray beam is probably the most important single factor in reducing patient exposure. Adequate coning is difficult to attain in practice. Fairly good results can be obtained with some types of variable aperture collimators, particularly if they completely illuminate the field with visible light. Gonadal shielding is recommended for all examinations involving the lower trunk, however, as an additional precaution.

Additional protective techniques readily applicable to most units include added filtration, fast film, full-film processing, and correct exposures. To these may be added under some circumstances fast cassette screens and high-kilovoltage technique.

Fluoroscopic output can be reduced at the tabletop or panel to 5 r a minute or less without much difficulty. Personnel exposure in fluoroscopic examinations is not excessive if the usual protective garments are worn.

Pediatric fluoroscopes and chiropractic installations used for spinograms are discouraged.

For good results, persons in radiation safety programs dealing with diagnostic X-ray units need a detailed understanding of X-ray work, both from the theoretical and practical viewpoint. They must also be familiar with the complex current exposure standards and with diagnostic radiology. One cannot depend on simply recommending that "adequate coning be provided," for instance, if success is to be expected. Specific advice is demanded on all details of accomplishing the desired improvements. For this purpose, special instruction forms and explanatory materials for owners and operators are a useful supplement to counsel and surveillance.

Information concerning the Public Health Service inspection programs and training courses can be obtained by writing to the Division of Radiological Health, Public Health Service, Washington 25, D.C. Copies of inspection forms used in Oregon can be obtained by writing to the Oregon State Board of Health, Portland 1, Oreg.

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Occupational Health Notes

Carbon Tetrachloride Poisoning

In Tennessee a worker brushing a bonding agent on metal plates to hold a rubber mat developed acute nephrosis. Samples from the worker's breathing zone showed concentrations of carbon tetrachloride and xylene above the maximum allowable concentration.

Sawdust Trail

A dust explosion and fire recently destroyed the cyclone collector and sawdust bin of a hardwood flooring company at Everett, Pa. Apparently, the explosion and blaze resulted from overheated sawdust on rafters in the boilerroom adjacent to the dustbin and cyclone collector. Rafters which supported the boilerroom ran through the common wall and across the dustbin. There was no solid wall between the dustbin and boilerroom. Ignited dust on the rafters above the boiler burned in a slow trail to the dustbin where the explosion occurred.

It is customary for lumber plants to collect sawdust in a cyclone and dustbin, and to burn it in the boiler. For safety, it is recommended that a solid firewall separate dust collection units and boilerroom; that dust be prevented from accumulating on rafters above the boiler; and that firing the

boiler with sawdust be done with care to prevent a backflash. It is also good practice to keep the fire-door between dustbin and boilerroom closed except to remove sawdust for burning and to keep flammable material away from the boiler and sawdust bin. Without such precautions, a dust collector and a boiler are potential dynamite.

—W. C. MAWHINNEY, *industrial hygienist, Pennsylvania Department of Health.*

Celery Workers' Rash

Pink rot, a fungal disease of celery, causes a skin rash among cutters who handle celery before it is washed in the packing sheds. Most frequently the cutters complain of blisters which break and develop into a depigmented type of lesion, but the disease can also cause hyperpigmentation. The hyper- or hypopigmentation may last for 9 months.

At the request of the Michigan Department of Health, the Occupational Health Branch, Bureau of State Services, Public Health Service, studied the dermatitis among workers on 15 farms in that State. Patch tests on celery workers and volunteers at the Occupational Health Field Headquarters indicate that the cause of the rash is photosensitization of pinkrot-diseased celery.

Exposure to Microwaves

Experience and research have not indicated a need to change the present standard, 10 milliwatts per square centimeter, of a safe working exposure to microwaves, it was reported at the Third Tri-Service Conference on the Biological Effects of Microwaves held at Berkeley, Calif., August 27-29, 1959.

A Food Poisoning Outbreak Aboard a Common Carrier

CHARLES J. HART, M.P.H., WADE W. SHERWOOD, M.D., and ELIZABETH WILSON, Ph.D.

IN the spring of 1959, a special railway train carrying visitors to a national conference was the source of one of the largest outbreaks of food poisoning on record in this country. Of 450 passengers aboard nearly half were affected, 25 of whom required hospitalization.

An interesting element of the event was that investigators found a clue which may lead to a new line of investigation, and so may enable health officials to identify agents of food poisoning outbreaks which usually are reported with "origin unknown."

Two meals were served aboard the special train during the overnight trip—a cafeteria-style dinner served between 6:00 p.m. and 8:00 p.m., and breakfast between 4:00 a.m. and 6:30 a.m. However, the breakfast meal was not suspected, since the peak of the outbreak had

been reached before breakfast was served, and many of the victims did not partake of it. The dinner meal consisted of roast turkey, dressing, gravy, cranberry sauce, mashed potatoes, green peas, bread, butter, ice cream sundae, and coffee (with or without cream), tea, or milk. Since there was no separate charge for the meal, the same menu was served each passenger. Passengers from one coach at a time went to the dining car for their food and then returned to their coaches to eat it.

During the night, some of the passengers experienced episodes of acute gastroenteritis, the number reaching a peak after 1:00 a.m. The distribution of 181 of the cases by onset time is shown in the graph. The onset time for seven additional cases is unknown. The frequency of symptoms reported by the 188 persons with gastroenteritis is shown below:

Symptoms	Number of patients	Percent of patients
Stomach cramps	164	87.3
Diarrhea	163	86.7
Headache	94	50.0
Nausea	92	48.9
Chills	54	28.7
Vomiting	46	24.4
Feverishness	40	21.2
Sore throat	20	10.6
Other	23	12.2

It appeared that the syndrome consisted primarily of severe abdominal cramps and watery diarrhea with nausea and vomiting less prominent. Nearly all the patients had improved within 12 hours and, although distressing to the patient, the illness appeared to be

The authors are with the Public Health Service. Mr. Hart is a sanitation consultant with the General Engineering Branch, Division of Engineering Services; Dr. Sherwood is an epidemic intelligence service officer with the Communicable Disease Center, Atlanta, Ga.; and Dr. Wilson is a bacteriologist with the Milk and Food Research Branch, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

*Consultation and laboratory studies on the cultures of *Clostridium perfringens* were provided by Dr. Howard E. Noyes, Walter Reed Army Institute of Research, Washington, D.C., and Dr. Betty C. Hobbs, Central Public Health Laboratory, London, England. Laboratory assistance was provided by Matthew Fusillo, D.C. General Hospital; Dr. David L. Rogers, Communicable Disease Center; and Dr. Keith H. Lewis and Dr. Milton J. Foter, Robert A. Taft Sanitary Engineering Center.*

of minor physiological consequence. Of the 25 hospitalized patients, who were the more severely ill; only 2 had temperatures (taken rectally) over 100° F., 1 of 100.4° and the other, 100.6°. The incubation periods of the 181 patients for whom sufficient information was available ranged from 1½ to 26½ hours, with a median of 9 hours, 35 minutes.

Information available from 301 passengers according to foods eaten and not eaten is shown in the table. Statistical analysis of these data, using a one-tailed chi-square test, shows that the increased risk which was associated with eating turkey dressing could be expected by chance less than once in a thousand times. The figures for turkey are not suitable for the chi-square test since so few persons did not eat turkey. Lesser, but significant, increase in risk was associated with eating bread and with eating ice cream. However, study of those eating these four foods separately and in various combinations reveals that the hazard from eating turkey, bread, and ice cream is due to the coincident eating of turkey dressing.

A sanitation survey of the train, crew, and food-handling operations was made by representatives of the Public Health Service. It was determined that all preparation and serving activities took place in the dining car. The food used in the preparation of the dinner was placed on board the diner approximately 36 hours before the train departed. Since approximately

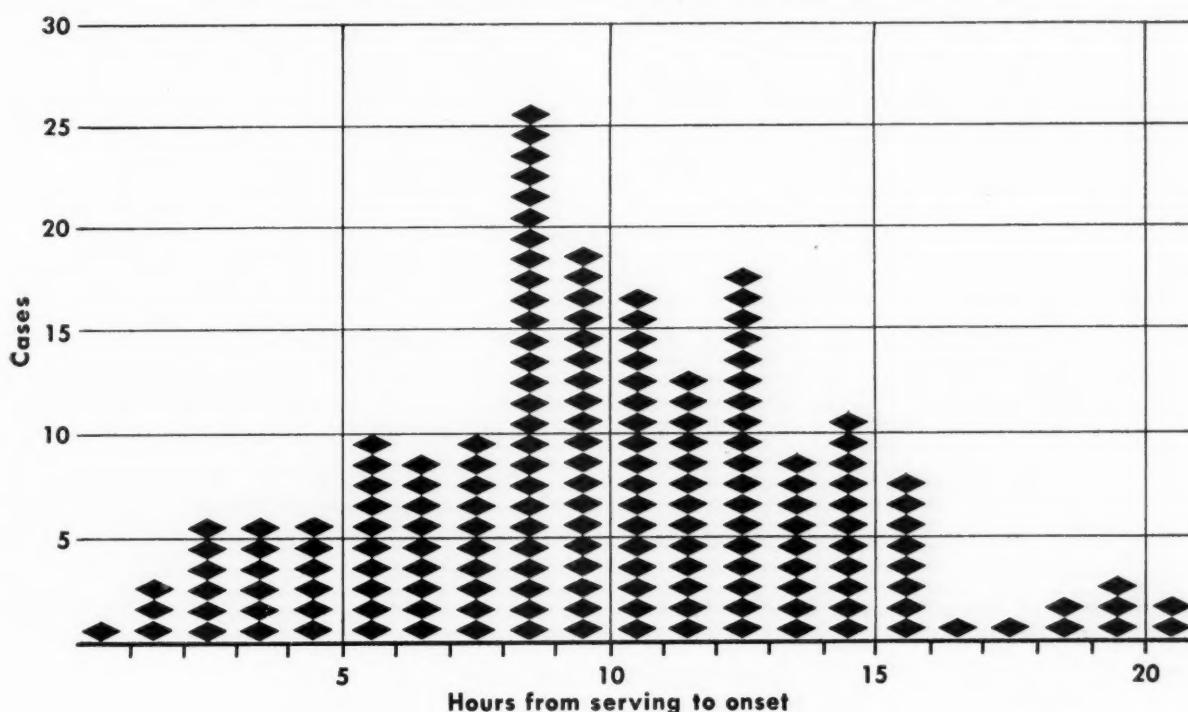
450 people were to be fed from the car, food preparation activities were begun approximately 30 hours before the serving, while the car was being moved to the train loading point. It is reasonable to assume that the quantity of perishable food involved must have severely taxed the refrigeration facilities of the car.

Turkey, the dinner entree, was initially considered a prime suspect as the causative factor of the outbreak. The turkeys had been purchased from a large meatpacker and, through prior arrangement, were delivered partially thawed directly to the dining car. Half of the 22 turkeys used in the meal were prepared Monday, starting about noon. Legs, thighs, and wings were boiled to make stock for the dressing and gravy. The backs were removed and sent to the railroad commissary for other use, and the breasts were baked in the oven. The stock and turkey were cooled at room temperature for approximately 2 hours before being placed in the refrigerator. The remaining turkey breasts were baked on Tuesday, and additional stock was prepared by boiling the remaining legs, thighs, and wings. The stock prepared on Tuesday was not refrigerated. On Tuesday afternoon the turkey was cold-sliced, put in pans with stock added for moisture, and reheated in the oven for about 45 minutes. After removal from the oven, the pans of sliced turkey were placed on top of the stove until serving time at 6:00 p.m. The dressing

Gastroenteritis attack rates per 100, by foods eaten by 301 train passengers

Food	Eaten			Not eaten		
	Total number	Number ill	Rate	Total number	Number ill	Rate
Turkey	296	187	63.2	5	0	0.0
Dressing	261	174	66.7	40	13	32.5
Gravy	269	170	63.2	32	17	53.1
Cranberry sauce	182	113	62.1	119	74	62.2
Potato	276	171	61.9	25	16	64.0
Peas	258	162	62.8	43	25	58.2
Bread	273	173	63.4	28	14	50.0
Butter	260	164	63.1	41	23	56.1
Ice cream	257	161	62.7	44	26	59.2
Milk	130	84	64.6	171	103	60.3
Coffee with cream	145	93	64.1	156	94	60.2
Coffee, black	62	36	58.1	239	151	63.2
Other food	53	28	52.8	248	159	64.1
Breakfast	282	171	60.7	19	16	84.2
Water from train	258	155	60.1	43	32	74.4

Distribution of 181 cases of food poisoning on an interstate carrier, 1959



was prepared Tuesday afternoon from bread, onions, celery, eggs, spices, and the stock.

The dining car refrigerator which was used to store a large portion of the perishable food was an old type "wet ice" box. At the time of inspection, about noon on Wednesday (the day the outbreak was discovered), the temperature of this refrigerator was 62° F. No supplementary dry ice was used to help cool the box, nor had any been used during the trip.

Samples of remaining turkey, dressing, beef, bread, milk, cranberry sauce, tomato juice, and bacon were examined bacteriologically to determine the total aerobic plate count and the presence of salmonellae, coagulase-positive staphylococci, enterococci, and clostridia.

All samples of drinking water taken from the diner and each of the coaches of the train were negative for coliform organisms. All samples of food were negative for salmonellae and coagulase-positive staphylococci.

However, the plate counts and determination of the most probable number (MPN) of enterococcus showed that cooked turkey, and especially the turkey dressing, contained large numbers of bacteria. For example, one sample of turkey had an aerobic plate count of 43 mil-

lion bacteria per gram and a confirmed enterococcus MPN of 4.6 million per gram. A sample of turkey dressing showed a plate count of 37 million bacteria and an enterococcus MPN of 240 million per gram. In contrast to the large numbers of bacteria found among the cooked samples from the railroad, very low values were observed for uncooked frozen turkey from the lot aboard the diner for which the plate counts were $8-72 \times 10^3$ per gram and enterococcus MPN < 100 per gram. These findings suggest that the conditions of food preparation and holding aboard the diner were conducive to heavy bacterial growth.

Discussion

Contradictory evidence exists in the literature about the pathogenicity of enterococci. They are commonly found in foods which cause no ill effects when eaten; however, feeding experiments on man suggest that large numbers of certain strains, if grown properly in selected foods, may produce illness (1).

Organisms resembling *Clostridium perfringens* (*welchii*) were isolated from thioglycolate enrichment cultures of turkey dressing taken from the diner. According to McClung

(2) and Hobbs and associates (3), outbreaks due to this organism are associated with meats and poultry that are cooked one day, allowed to cool slowly, and eaten the next day. Apparently, these circumstances prevailed in the preparation of food on the diner, the "stock" from the boiled wings and legs being used to moisten the dressing and to prepare the gravy.

Rectal swabs, blood, and vomitus for bacteriological analysis were taken from the 25 hospitalized patients. All of these specimens were negative for organisms of the typhoid, paratyphoid, and dysentery organisms, but *C. perfringens* was isolated from 13 rectal swab cultures.

The isolation of *C. perfringens* from incriminated food and from the victims' feces may be related. However, the clostridial isolates have not yet been identified as one strain. Although diarrhea and cramps are prominent in both enterococcal and clostridial food poisoning, the occurrence of vomiting in 24 percent of cases in the present outbreak resembles the reported enterococcal outbreaks more nearly than the clostridial (3,4). Further study of both types of organisms is contemplated.

In 1958, *C. welchii* (*perfringens*) was reported to account for 24 percent of the "general outbreaks" of food poisoning in England and Wales (5). However, these 64 outbreaks composed less than 1 percent of all incidents of food poisoning consisting of "general outbreaks," "family outbreaks," and "sporadic cases" occurring in that year. This is typical of the prevalence of *C. welchii* (*perfringens*) food poisoning in England and Wales as reported for the past decade. Food poisoning caused by this organism has either not occurred or has gone essentially unrecognized in the United States, since it was first observed by McClung in 1945 (2).

The identification of an organism as *C. perfringens* type A requires, in addition to anaerobic culture technique and numerous physiological tests, a series of procedures designed to elucidate the complex toxin-producing potential of the organism (3,6). These procedures are intricate and require antitoxins and reagents that are not produced commercially in the United States. Further identification

of a *C. perfringens* type A isolate as being food poisonous is based currently on heat-resistance of spores and serologic typing with reagents available only in England (3).

Most laboratories in the United States are not equipped to identify food poisoning strains of this organism because of the infrequency of *C. perfringens* food poisoning outbreaks and the unavailability of materials. Therefore, in an effort to compare the strains of *C. perfringens* isolated from samples of turkey dressing in this outbreak with those obtained from hospitalized patients, isolates from both sources were sent to the Central Public Health Laboratory, London, England, for serologic typing. *C. perfringens* isolated from patients, turkey, and dressing did not correspond serologically to those isolated in Great Britain in food poisoning outbreaks.

The occurrence of this outbreak emphasizes the scarcity in this country of the trained personnel and materials required for the identification of this organism and its various types. In order to fulfill its responsibility for control of foodborne disease aboard interstate carriers and for assistance to the State health laboratories, the Public Health Service needs to develop, evaluate, and disseminate information on the detection and identification of *C. perfringens*. Such techniques would permit an evaluation of the extent to which this organism is responsible for outbreaks of undetermined etiology, which now account for about one-half of the approximately 200 outbreaks reported annually in the United States.

Conclusions

Although the causative factor of this outbreak has not yet been conclusively identified, the need for greater care in the handling of food served to the public is emphasized. It indicates the need for adequate facilities to do a safe job and the need for additional training and supervision of those employees to whom the health of the traveling public has been entrusted. Finally, the outbreak has served to alert health officials that enterococci and *C. perfringens* should be considered as possible causative organisms in food poisoning cases, and that

there is an immediate need to equip our laboratories for the identification of these organisms.

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Health, Education, and Welfare Trends

A 90-page booklet entitled "Health, Education, and Welfare Trends, 1960" has been issued by the Department of Health, Education, and Welfare. A statistical digest dealing with the Nation's human resources, it contains data and charts on such subjects as illness and medical care, educational attainment, social insurance, public assistance, and vocational rehabilitation.

Among the facts cited in the publication are:

- Public and educational construction totaled \$3.2 billion last year. During the past 12 years public school construction has accounted for 80 percent of the total.
- For each of fiscal years 1959 and 1960, hospital construction outlays reached almost \$1 billion. Four-fifths of the money was from other than Federal sources.
- Despite reductions in recent years, there are still more than 600,000 resident patients of mental hospitals.
- All Federal grants-in-aid totaled \$6.3 billion in fiscal year 1959. Grants for health, education, vocational rehabilitation, welfare, and employment security accounted for \$3.5 billion of the total.
- Federal expenditures for research and development are expected to approach \$7.5 billion this fiscal year. Less than 4 percent is for programs administered by the Department of Health, Education, and Welfare.
- Civilian per capita food consumption is nearly 1,500 pounds per year. Two-thirds of the total consists of dairy products and eggs; meats, fish, and poultry; and fruits and vegetables.
- Private expenditures for medical care and voluntary health insurance total about 5 percent of disposable personal income. In 1958, per capita expenditure for medical care was nearly \$96, distributed as follows: \$30 for hospital services; \$25 for physicians; \$25 for medicines and appliances, \$10 for dentists' services; and \$6 for all other medical expenditures.

Copies may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 50 cents each.



CC 1

PHS Cancer Control Exhibits

Four new exhibits are available for loan from the Cancer Control Branch, Division of Special Health Services, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

The exhibits may be borrowed free of charge from the branch. For large national and regional meetings, the branch will pay all the

costs of shipping and installing them; for smaller meetings, primarily of local interest, these costs will be borne by the borrower.

Instructions for assembling the exhibits are affixed to the inside door of each crate. Two men can assemble any of them in 30 to 45 minutes. Requests should be sent at least 1 month in advance of the date the exhibit is desired.

As a Medical Technologist, A Life Is in Your Hands

Co-sponsored by the National Committee for Careers in Medical Technology, this exhibit is designed to aid in recruiting medical technologists. It emphasizes the importance of the profession, the fields in which technologists work (for example, cytology), and describes educational requirements and opportunities for employment. The exhibit is intended for possible recruits and those who disseminate information about careers, such as guidance counselors.

Specifications. (No. CC-1.) A 3-panel exhibit on legs, nearly 8 feet high, total weight 599 pounds, including the packing crate; center panel, 4 by 8 feet; 2 side panels,

each 4 by 4 feet, which swing forward on hinges as much as 90°. A minimum of 10 feet of backwall is needed. Lighting fixtures require one 1,500-watt outlet.

Examinations for Cervical Cancer

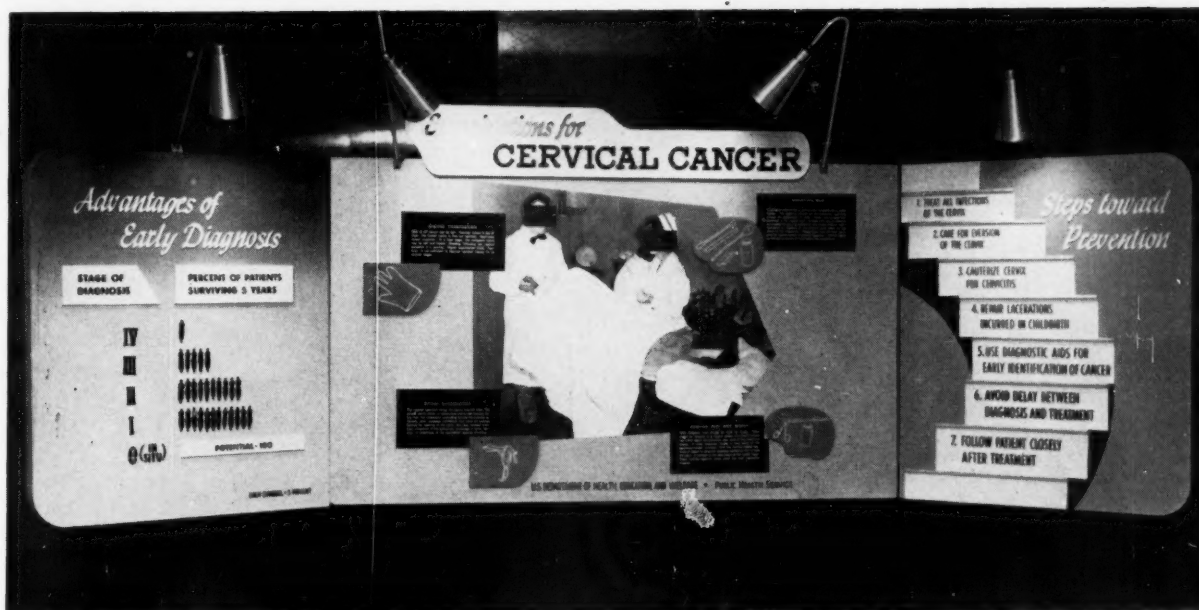
Four examinations for cervical cancer, advantages of early diagnosis, and steps toward preventing incursions of this disease are depicted on this exhibit, which was co-sponsored by the Tennessee Chapter of the American Academy of General Practice. It is intended solely for physicians.

Specifications. (No. CC-3.) A 3-panel exhibit on legs, nearly 8

feet high, total weight approximately 375 pounds, including packing crate; center panel 3 feet 6 inches by 7 feet; each of 2 side panels 3 feet 6 inches square, swinging forward on hinges as much as 90°. A minimum backwall of 10 feet is needed. Four 300-watt lamps attached to the top of the exhibit require one 1,200-watt outlet.

Silent Cervical Cancer Will Talk

Intended primarily for public health workers who are interested in screening programs for cervical cancer, the exhibit stresses medical consultation, teamwork, and examinations in high-risk groups.



CC 3

Specifications. (No. CC-2.) A 3-panel exhibit on legs, 7 feet high, total weight 300 pounds, including packing crate; center panel, 4 feet by 4 feet 10 inches, placed slightly behind the left panel and slightly in front of the right panel, each 4 feet by 2 feet 4 inches. Overall width is nearly 10 feet. A fluorescent light under the title and lamps attached to the top of the panels require one 1,400-watt outlet.

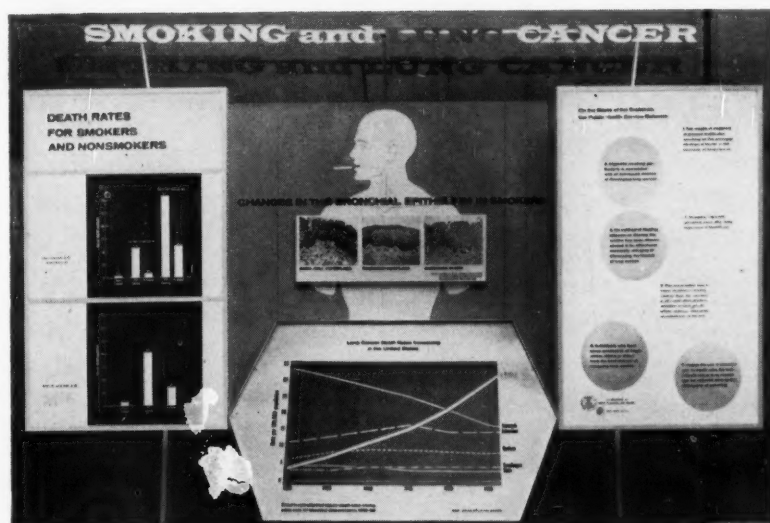
Smoking and Lung Cancer

This exhibit visualizes some of the major points presented in Surgeon General Leroy E. Burney's article, "Smoking and Lung Cancer," J.A.M.A. 171: 1829-1837, Nov. 28, 1959. The major points referred to are: death rates for smokers and nonsmokers, changes in the bronchial epithelium of smokers, the increasing death rate from lung cancer in the United States, and the conclusions reached by the Public Health Service on this issue.

Specifications. (No. CC-4.) A 3-panel exhibit on legs, 9 feet long, 7 feet 6 inches high, and 2 feet deep; total weight about 300 pounds, including packing crate. A separate literature rack requires a table 4 feet wide. Five fluorescent lights for the translucent panels require one 250-watt outlet.



CC 2



CC 4

Escherichia coli Strains As Etiological Agents Of Diarrheal Disease

FRED J. PAYNE, M.D.

A GREAT DEAL of evidence has been compiled during the past 15 years indicating that certain strains of *Escherichia coli* are intimately associated with diarrhea of the newborn. These *E. coli* strains are associated not only with cases of diarrhea occurring in hospital nurseries in the newborn but with sporadic cases occurring outside the hospital. In spite of the evidence, there is considerable doubt in the minds of many highly competent individuals that this association is one of cause and effect.

This paper reviews the currently available evidence concerning these organisms in an attempt to shed further light on this rather complex situation.

The idea that at least some strains of *E. coli* might be a causative agent of epidemic diarrhea of the newborn is not a new one. Adam described a biochemical type of *E. coli* which he felt was responsible for such an outbreak in Germany in the 1920's (1). He labeled his strain "dyspepsi-coli." However, biochemical variations do not permit a satisfactory classification of the genus *Escherichia*, and the work was not followed up.

Bray (2), working in Great Britain in the early forties, noted that the seminal odor which characterized the stools of infants with summer diarrhea originated from the *E. coli* found in them. Serologic studies showed the coli from

these cases were of one antigenic type. This strain, which was called *E. coli* var. *neopolitani*, was recovered from 100 percent of the sick infants and only 4 percent of the healthy infants in their series.

This work was followed by that of Giles and co-workers (3) who were able to incriminate a strain of *E. coli* by similar methods as the etiological agent of an outbreak. The strain was called *E. coli* alpha type. The same authors subsequently described another serologically distinct strain found in a second outbreak, which they named *E. coli* beta type. Taylor and co-workers (4) in London later described a strain called *E. coli* D-433 as the probable cause of an outbreak in a nursery there.

By this time Kauffmann (5) had completed work on a serologic typing schema for *E. coli*. He described the *E. coli* beta type of Giles and associates as belonging to O group 55 of his schema, with an envelope antigen B5. The type strain for this O group had been recovered earlier from the pus of a middle ear infection. He further demonstrated that the *E. coli* var. *neopolitani* of Bray, the alpha type of Giles and associates, and the D-433 of Taylor, all belonged to a new O group, which he designated 111, and that these strains had the same envelope antigen, B4. Since that time *E. coli* O55B5 and O111B4 have been found in widely scattered outbreaks of diarrhea of the newborn throughout the world. A number of other serotypes of *E. coli* have subsequently been found to be involved with this disease in single or multiple outbreaks. A recent review of this problem, with extensive bibliography, has been presented by Neter (6).

In most of the epidemics in which these organisms have been incriminated, the pattern has been similar. The particular coli type has been found to be present in almost pure culture in the stools of sick infants and has been found infrequently in the stools of healthy infants in the same environment.

I have had the opportunity to investigate five such outbreaks during the past 6 years. Two were associated with *E. coli* O55B5, two with *E. coli* O111B4, and one with *E. coli* O127B8.

Rarely were members of the nursery staff found to be infected with the epidemic strain in these outbreaks. The source of four of the

Dr. Payne is assistant chief of the Phoenix, Ariz., field station of the Communicable Disease Center, Public Health Service. The article was presented as a paper at the 17th annual conference of the U.S.-Mexico Border Public Health Association in Brownsville, Tex., and Matamoros, Tamaulipas, Mexico, on March 31, 1959.

outbreaks could not be clearly determined. But in one instance an infant acutely ill with diarrhea was admitted to an open pediatric ward and ignited an outbreak.

As an increasing number of outbreaks associated with these organisms were reported, the problem of their epidemiology outside the hospital became more pressing. A study done by the Public Health Service in New Orleans in an effort to find O groups 55 and 111 in healthy infants and children disclosed one O111 in 576 children. Similar studies carried on in Denmark on an even larger scale showed a similarly low yield (7).

More Etiological Agents

Subsequent studies have contradicted these earlier findings. Gamble and Rowson (8) reported that they had found enteropathogenic *E. coli* in 20 percent of their routine stool examinations in infants under 1 year of age. Their reason for designating some of the serotypes in their investigations as enteropathogens is not clear; however, they include types which are not generally accepted as enteropathogenic. This serves to illustrate a fundamental problem in working with these organisms. We must be exceedingly careful in our designation of a type as enteropathogenic. Only for three serotypes, O111B4, O55B5, and O127B8, do we have what amounts to conclusive evidence that their association with diarrhea is one of cause and effect. They have been found repeatedly throughout the world associated with epidemic diarrhea of the newborn, and they have been shown experimentally to be capable of producing a gastroenteritis in human adults when ingested in large numbers.

In addition to these three types, evidence is mounting that certain other types alluded to earlier in this paper may be etiological agents as well. These are O26B6, O86B7, O112B11, O119B14, O124B17, O125B15, O126B16, and O128B12. In all, about a dozen types fall under scrutiny as possible or probable enteropathogens on the basis of previous involvement in nursery outbreaks. Until we are sure not only of their pathogenicity but also of their epidemiological characteristics, we must be careful about interpreting data which lump them all

together. For the present, the data for each type must be analyzed separately and evaluated on its own merits.

In studies carried out in Phoenix, Ariz., from October 1957 through February 1959, enteropathogenic *E. coli* have been associated with 25 percent of some 474 cases of acute diarrhea in children under 2 years of age admitted to three hospitals in the area. *Shigella* infections accounted for an additional 25 percent. Among 98 infants under 2 months of age in this series, however, these *E. coli* types were found in 40 percent, whereas shigellae were found in only 8 percent. It is obvious that in the age groups where the highest mortality occurs, enteropathogenic *E. coli* constitute a very important cause of diarrhea. Almost half (46 percent) of the *E. coli* infections in this age group were with O groups 111 and 55.

In an attempt to piece together the epidemiology of the enteropathogenic *E. coli* as it exists outside the hospital, we have carried out studies on the families of infants who are admitted to the hospital infected with one of these organisms. We found that the infection rate among 244 contacts of all ages for all types of *E. coli* was 12.4 percent. Only rarely was a type encountered other than the one found in the index case. The rate varied little by age group. It was 14 percent in the age group 0 to 4 years and 13 percent in the age group 20 to 49 years. The secondary infection rate varied somewhat by type; however, the rate was 17 percent for O55 compared with 10 percent for O111 and 7 percent for O126. The numbers of other types were too small for individual analysis, but collectively their secondary infection rate among family contacts was 11 percent.

These rates are somewhat higher than those obtained for salmonellae in the same study. The secondary infection rate among family contacts of patients with salmonellosis was 8 percent. One must be cautious in interpreting this difference, however, because the ability of the laboratory to recover salmonellae and enteropathogenic *E. coli* from carriers is probably quite different. With better tools, the rate for *E. coli* could be expected to be considerably higher. No evidence has been uncovered as a result of these investigations which would

allow us to draw hypotheses as to the epidemiology of these organisms. All of the families were poor since our cases were principally charity cases. Pets or livestock were found infrequently on the premises. The diets of these people are marginal, but overt malnutrition is uncommon.

Conclusion

There appears to be a cause and effect relationship between at least three serotypes of *E. coli* and diarrhea of the newborn. In addition, there appears to be a relationship between eight or nine other serotypes and this disease. Perhaps still others will be found in the future.

The natural history of these types outside hospital walls remains obscure, but they constitute a leading cause of cases of severe diarrhea among infants under 2 months of age whose onsets are at home as well as those occurring in hospital outbreaks. There is no assurance that environmental control measures now in vogue for diarrheal diseases will be effective in the control of these agents.

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New Radiation Health Publication

The first issue of a new monthly technical publication giving levels of radioactivity in the environment appeared in April 1960.

Entitled *Radiation Health Data*, the publication is prepared by the Public Health Service as an outgrowth of a directive by the President in August 1959 that the Department of Health, Education, and Welfare "intensify its radiological health efforts and have primary responsibility within the executive branch for the collation, analysis, and interpretation of data on environmental radiation levels."

Data on radiation levels in the air, water, and milk comprise the bulk of this issue of the periodical, which presents facts compiled from a number of sources by the Public Health Service's Division of Radiological Health, with the assistance of a board of editorial advisers representing the Departments of Health, Education, and Welfare, Defense, Agriculture, and Commerce, and the Atomic Energy Commission.

Among the contents of this issue are data on strontium 90 in milk collected during November 1959 at 12 locations in the United States by the Public Health Service; milk collected during the same month at 3 locations by the Atomic Energy Commission; and monthly milk collections for the year ending August 1959 at 6 locations in Minnesota as reported by the State health department.

Most of the radiation measurements carried by the new publication will be in the form of raw data which will be susceptible to meaningful analysis or interpretation when these data accumulate and more knowledge of the biological effects of radiation begin to come out of research by Federal, State, and local agencies, and by industry and universities.

The price of the publication is 50 cents an issue or \$3 per 6-month subscription. It is available from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C.

Impact of Government Programs on Voluntary Hospitals

MILTON I. ROEMER, M.D., and MARY HELEN McCLANAHAN, M.A.

A LONG CONCERN in American life has been to extend health services to the population through organized measures, while not stifling individual initiative and responsibility. This concern is now particularly directed to the potential influence of government on our voluntary hospital system. Fear is expressed that various financial innovations may lead to governmental domination or even the complete governmental control of hospitals.

This is, of course, not the first time that the phenomenon of governmental participation in the provision or the financing of health services has been greeted with apprehension. Voluntary initiative is naturally cherished in America, and encroachments on it, even if they are only potential, have long been resisted. Yet over the years the role of government in health service has steadily expanded. New public programs have evolved at all levels: local, State, and Federal. And these programs have involved a widening scope of technical activities in medical care in general and hospital service in particular.

It is not necessary, therefore, to speculate unduly on the influences of government on voluntary social institutions. A vast experience exists and can be studied. Specifically, it is quite possible to determine the actual impact of governmental programs on voluntary hos-

pitals in the United States. This paper reports the preliminary findings of such an investigation.

Our first task was to identify and define the principal governmental programs now impinging on voluntary hospitals. These are found operating at all political levels and may be conveniently classified as programs which support specified beneficiaries, provide general financial assistance, or have regulatory authority. We are not considering governmental provision of hospital service per se, an expanding practice also, but rather only governmental impacts on existing voluntary hospitals. The principal governmental programs whose impacts were to be explored were classified as follows:

Support of Specified Beneficiaries

Federal

- Veterans "hometown" care.
- Military dependents ("Medicare").
- Members of the armed services on leave.
- American Indians.
- Federal employees with compensable injuries.
- Other Federal beneficiaries.

State

- Public assistance "categorical" recipients (old-age assistance, dependent children, blind, or totally and permanently disabled).
- Injured workers (workmen's compensation).
- Patients with cancer or other specific conditions (in certain States), excluding mental illness and tuberculosis.
- Vocational rehabilitation clients.
- Other State beneficiaries.

Local

- General assistance recipients.
- Other local government beneficiaries.

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Provision of General Financial Assistance

Federal

- Hospital construction grants (Hill-Burton law).
- Research grants.
- Federal tax exemptions.
- Other Federal assistance.

State

- Hospital construction grants (certain States).
- Research grants.
- Laboratory or X-ray services.
- Commodities (drugs, food, and so on).
- State tax exemptions.
- Other State assistance.

Local

- General financial grants, such as "deficit" subsidy.
- City or county tax exemptions.
- Other local government assistance.

Regulatory Programs

Federal

- Narcotics and alcohol control.
- Federal trade and labor legislation.
- Other Federal regulations.

State

- Hospital licensure or approval law.
- Supervision of nursing education.
- Labor legislation (protection of women and children, and so on).
- Other State regulations.

Local

- Public health or sanitary regulations.
- Fire prevention code.
- Other local regulations.

Thus, there are some 30 clearly definable governmental health programs, and several "others" which may be found in different places, now operating in an average community. All or most of these may be expected to have a variety of impacts on voluntary hospitals. The problem is complicated by the fact that for nearly every program a different Federal, State, or local public agency is involved. From the research point of view, however, this widens the sample of "influences" and permits more reliable generalizations.

The nature of these governmental impacts on hospitals is not so easy to define, let alone to measure. Objective effects may be quite different from subjective perceptions. As a first approach, however, we felt that some insight could be gained by tapping the impressions of hospital administrators on the effects of these specific

programs. Thus, we set out to examine the "observed" impacts of governmental programs on voluntary hospitals, which hopefully correspond closely but not necessarily exactly to the objective impacts of these programs.

For each program listed, the potential impact was to be examined in terms of one or more of five aspects. These concerned the program's influence on patient care, motivation of the hospital staff, administrative practices, financial support, and development of services and facilities. A schedule was constructed to elicit impressions of hospital administrators on all or some of the potential consequences that might be anticipated from each of the specific programs. The first draft of this schedule was pretested by interviewing six hospital administrators from six different States, who were available at a summer postgraduate institute. After revision on the basis of this testing, the schedule was applied, by direct interview of the administrators, in 10 hospitals of upstate New York. The final study will cover about 100 hospitals in several States. These interviews, carried out on the spot in each hospital, were done with care, requiring 3 to 8 hours each. In six places they were supplemented by interviews with other members of the hospital staff for data on specific points.

Findings

The 10 institutions in which governmental impacts were examined were all general hospitals under voluntary nonprofit auspices. Two were Catholic, the others nonsectarian. They ranged from 52- to 450-bed capacity, with an average size of 218 beds. All were well established in their communities, the newest being 34 years old and the oldest 108 years. No claim is made as to the representativeness of this sample; it was selected mainly by proximity of the hospitals to Cornell University, but with an effort to cover a range of sizes and to include several which had received Federal construction grants. The findings, however, on the observed impacts of current governmental programs on voluntary hospitals provide several clues which may be later explored in a larger sample of institutions. The effects of each type of governmental program, in the judgment of the

hospital administrator, will be considered according to the general categories cited.

Specified Beneficiaries

All 10 voluntary general hospitals served one or more of the several categories of health beneficiaries of the Federal Government. The volume of such cases in all instances, however, was small. The recent trend, moreover (within the last 10 years), has been toward a stationary level or a decrease in the percentage of total hospital income derived from this source. It was for this reason perhaps that the administrators stated that the several programs for Federal beneficiaries had only a negligible influence on overall hospital operations, including utilization, financing, patient care, or other possible consequences.

In response to a specific question on whether these Federal funds for specified beneficiaries "have caused the Government to exercise control over your operation or management," all 10 administrators responded "no control." The same uniform response followed a question on whether the Federal program had "caused, either directly or indirectly, the board in your hospital to change its policies and programs." Furthermore, all reported "cooperation between the hospital staff and Government officials administering Federal medical care programs" to be "good" or "very good." None reported relationships as "fair," "poor," or "very poor." These uniformly favorable reports are perhaps all the more remarkable in view of the fact that four or five separate Federal agencies are involved in the administration of these programs.

All 10 hospitals reported service to one or more groups of specified beneficiaries of the New York State government. The relative volume of cases, again, was small; those who could estimate its financial impact on the hospital believed it to be under 1 percent of the total income. Mentally ill and tuberculosis patients were not considered in this report since they are customarily cared for in State-operated hospitals. The patients usually recognized as beneficiaries came under the vocational rehabilitation, crippled children's, or workmen's compensation programs, involving three separate State agencies. Statewide data show that payments for workmen's compensation cases con-

stitute about 2.5 percent of hospital income, an impact obscured by the fact that, although workmen's compensation is a governmental program, payments are made by different insurance companies. In New York State, public assistance beneficiaries are not handled by the State but by local units of government. A few administrators stated that the funds received for these beneficiaries had been of some help to the hospital in developing rehabilitation services. In all instances, relationships with State government officials were said to be "good" or "very good."

Specified beneficiaries of local governments were also served by all 10 hospitals. Indeed, since local governments in New York State are responsible for all categories of public assistance recipients, the estimated volume of care provided this group by the local government was greater than that provided for beneficiaries of Federal and State Governments. However, it should be kept in mind that the funds for financing medical care of these needy persons are derived from the Federal and State, as well as local, governments, even though the payment of hospital and medical bills is a function of county welfare departments. As a portion of hospital income, funds paid by local government for its beneficiaries were estimated to vary between about 1 percent and 11 percent, with half of the administrators stating 5 percent or more.

With this larger relative volume of beneficiaries coming under local government administration, it is not surprising that the observed effects of government participation in health services were greater for local than for Federal and State Governments. Half of the 10 administrators stated that these local government funds had enabled them to give better care to patients. Comments were made on the effect of these programs in helping to finance better equipment, improved child health services, rehabilitation, and outpatient department services, or in maintaining higher utilization of the institution. One hospital, incidentally, was reported to have kept its bed complement above a certain threshold level, in order to be entitled to a higher reimbursement rate for the care of local government beneficiaries. Greater impacts on a hospital were associated with higher

percentages of income derived from local governmental sources.

In contrast to health services for State and Federal beneficiaries, administration of programs for beneficiaries of local governments drew some criticism. Two hospital administrators expressed the belief that the program exercised some control over the operation of the hospital. One of these expressed fears about the future extension of governmental supervision over the care of the indigent, although current "controls" were deemed to be reasonable. No specific question was put to the administrators on the adequacy of local governmental payment rates, but in response to an invitation for "other comments" four volunteered that the rates were inadequate. One of these remarked specifically about the exclusion of expenses for teaching and research in computing hospital per diem costs. In this connection, it should be kept in mind that payment rates to hospitals by local welfare agencies for the care of needy persons are determined in part by the New York State Department of Social Welfare. In one instance, there was a complaint about the payment rate for hospital care by a Federal program, that for military dependents. As for relationships with local government officials, seven hospitals reported them to be "good" or "very good," but three stated that they were only "fair."

It is evident that among the three levels of government responsible for supporting hospital services for designated beneficiaries, negative reactions of hospital administrators seemed to be concentrated on local agencies. Even here, however, the majority of the hospital administrators interrogated appeared to evaluate the impact of the governmental program favorably.

General Financial Assistance

Federal, State, and local governments all provide varied forms of general financial assistance, not tied to specific beneficiaries. At the Federal level, best known is the Hill-Burton program providing grants to the States for helping to meet hospital construction costs. Five hospitals in the study had received such aid. The administrators of all five stated that these grants had not led to any governmental

control over hospital operation, but one thought the construction standards applied were "excessively demanding." The only comment on "controls" over hospital operation by the Federal Government was made by one administrator regarding supervision over the use of radioactive substances; this is exercised by the Atomic Energy Commission and was deemed to be reasonable. Four administrators of hospitals receiving construction grants believed their hospitals had been aided in providing improved patient care.

Federal research grants had been received by two hospitals. These administrators thought the requirements for receipt of this assistance were reasonable or "nonexistent." These grants were said to add prestige to the hospital, thus facilitating recruitment of staff, and to improve the care of certain patients. However, one administrator mentioned space problems caused by the research work.

Other forms of Federal assistance come to hospitals through certain benefits in kind. Nine hospitals had received surplus food from the U.S. Department of Agriculture, according to a formula based on the number of welfare beneficiaries served per month. Seven had received durable surplus property, including autoclaves, incubators, and office equipment, through the New York State Department of Education. The reaction to this type of assistance was generally favorable because of the financial savings.

The State government provides general financial assistance to hospitals in the form of free laboratory services. Four of the 10 voluntary general hospitals in the study reported such aid through the privilege of having serologic tests and various bacteriological examinations done without charge by a State public health laboratory. It is probable that more than these four hospitals avail themselves of such State services.

A variety of other forms of assistance from the State government was reported by several hospitals. These included free drugs, such as silver nitrate for instilling in the eyes of newborn infants and poliomyelitis vaccine for immunizing hospital employees. Two hospitals mentioned support for routine chest X-rays

on all admissions, through a New York State Department of Health award of \$1 per film. Other benefits mentioned were the training of a hospital laboratory technician in a State laboratory, with governmental assumption of the technician's salary during the training period, provision of teaching material for a prenatal class, the services of a heart specialist at periodic cardiac clinics, and epidemiological consultation on a problem in the nursery for the newborn. One hospital, which serves as a teaching center for a New York State-operated medical school, receives a substantial subsidy from the school; its agreement with the State government calls for a grant to meet the annual deficit, after an official audit. In 1958, for example, this amounted to \$240,000.

All of these forms of general financial assistance from the State government, direct or indirect, were regarded favorably by the hospital administrators, and were not associated with excessive administrative demands.

At the local government level, none of the 10 administrators reported aid in meeting construction costs, balancing of deficits, acquisition of real property, or the like. Three hospitals reported that free diagnostic tests were performed for the hospital by a county or city governmental laboratory; another hospital performed laboratory services for the county health department, for which payment was received. Two hospitals enjoyed savings on their water bill, through special action of the local government.

One other form of indirect financial support is provided to all voluntary nonprofit general hospitals by all levels of government. This is exemption from certain taxes which must be paid by other economic enterprises. The administrators were queried on the procedural requirements for receiving these tax exemptions. All 10 thought the Federal and State Government requirements reasonable for granting the exemptions. In addition, five hospital administrators cited exemption of tax payments on alcohol as offering significant savings; one of these mentioned a saving of \$19,000 in the previous year.

Exemption from local property taxes was reported by nine hospitals. The 10th institution is associated with a private medical clinic

and pays \$8,000 a year in local taxes. Of the nine hospitals, six administrators said the local tax exemption was a substantial benefit, two a moderate benefit, and one thought it inconsequential.

Regulatory Functions

Unrelated to any program of financial support, Federal, State, and local governments exercise certain regulatory authority over voluntary hospitals. The statutory authorities for these regulations differ widely, but all are designed to protect the public interest. The most widely applicable Federal regulation affecting hospitals is the narcotics control program of the Treasury Department. All 10 hospital administrators were familiar with this authority, and 9 thought it was reasonable. The 10th was critical only because he believed that the scope of the controls was not broad enough; he thought they ought to be extended to cover all hypnotic drugs, as well as the legally defined narcotics.

As implied by the restricted Federal authority specified in the United States Constitution, regulatory functions are exercised most extensively at the State government level. Voluntary general hospitals come under the supervision of several separate State agencies, with respect to different matters.

In contrast to most other States, overall certification and approval of hospitals in New York is a responsibility of the State department of social welfare, and all 10 administrators had had some experience with this authority. The frequencies of official inspections recalled by the administrators, however, varied greatly. Two stated the last inspection had been made 6 years ago, one estimated the frequency of inspections as "every 5 years," two as "every 3 years," two as "every 2 or 3 years," and the remaining three as "less than annual" or "don't know." As the apparent irregularity of these visits might suggest, the estimated impact of this regulatory program was uneven. Three administrators thought the inspections were inadequate and made no particular difference to the hospital. Two thought the inspectional authority "excessive," but still exerting "no effect" on the administration of the hospital. Two others thought the program

"about right" in its scope, yet having "no effect" on the hospital. On the other hand, three administrators thought the inspectional authority to be proper and to have stimulated improvements in the operation of the hospital. One of these explained that the social welfare department inspections and recommendations gave the administrator "leverage" with the board of directors in initiating needed changes in the hospital.

Despite the irregularity of on-the-spot inspections by State authorities, all hospitals must send financial reports annually to the State welfare department. No objections were raised to this requirement, which serves as a basis for computing maximum reimbursement rates, shared by the State government, for the care of public assistance beneficiaries. Reports are also required of any new construction at a hospital, and architectural plans must be approved by the State welfare department regardless of the source of financing, that is, independent of approval of construction under the Federal Hill-Burton program. This requirement was criticized by two administrators, who thought it was unnecessarily time consuming and unreasonable. They questioned how review of construction plans by a nurse could be justified.

In New York State, inspection and approval of nurseries for the newborn is a function of the State department of health. While overall hospital approval has long been a welfare department responsibility, a number of tragic epidemics of diarrhea among infants in hospital nurseries some years ago led to the assignment of special authorities in this field to the public health agency. The standards applied in this regulatory field are apparently somewhat rigid, and comments on them by the administrators were more voluble than on any other type of regulation. Three administrators complained that the nursery regulations caused additional expenses and much extra work. There was dissatisfaction with the requirement that nursing personnel could not be transferred from the maternity service to other sections of the hospital, even in periods when occupancy in the maternity ward was low. These administrators felt that this requirement caused inefficient use of expensive manpower. Yet they all conceded that these regulations had stimulated improve-

ment in the quality of care of the newborn. One administrator was seeking financial support from the State government for the operation of a unit for premature babies.

Supervision of schools of nursing comes under the State department of education. Four of the 10 hospitals studied conducted such schools, and the directors of these nursing schools were interviewed. All four thought the educational regulations were reasonable and helpful and gave the schools adequate leeway in running their own affairs. One director, however, expressed the view that the department of education overemphasized the academic, as against the practical, aspects of the nursing school program.

A variety of other State government regulations were mentioned by the hospital administrators, but none with any rancor. The legal supervision by the New York State Department of Labor on employment of minors was deemed reasonable, as was the safety inspection of water boilers and elevators. Two administrators even expressed the opinion that State requirements on fire prevention and sanitation might desirably be imposed in communities where local regulations in these fields were weak or lacking. Occasional inspections under the food and drug control laws of the State were mentioned, without objection. One administrator did make reference to the professional licensure acts for nurses and pharmacists, with the comment that they tended to restrict hospitals unduly in the engagement of such personnel.

Turning to regulatory functions under local government, all 10 hospital administrators had noted the operation of local regulations in the field of environmental sanitation. This authority, exercised by the local health department or health officer, was deemed reasonable by eight administrators. The criticisms by the other two, indeed, were that the standards applied were inadequate or that enforcement was too weak.

Fire prevention regulations were recognized by nine administrators, without any negative reactions. As an example of the concrete effects of these regulations, one administrator reported the recent installation of new fire protective equipment. Local regulations on the control of air pollution (furnace operation)

were criticized by two administrators as excessively demanding.

Competition by Government

A final aspect of governmental impacts on voluntary general hospitals, which had not been anticipated in the original research design, emerged from the interviews with administrators. This was the role of government as a "competing" organization through its operation of public hospitals. We did not examine this effect in detail, but certain findings appeared.

Apparently due to their location in a large city, where a Federal Veterans Administration hospital exists, two hospital administrators reported a double influence of government on voluntary hospitals. First, they stated, the Federal hospital "took patients away" from them; if a veteran was legally entitled to free care in a governmental facility, why should he pay for it in a voluntary unit? Second, the personnel policies of the VA hospital, especially the wage rates, put the voluntary hospitals under pressure to offer competing conditions in order to recruit staff. While the two administrators could not really condemn these competitive forces, they said their jobs were thereby made harder.

A similar competitive influence of State government was reported by one administrator, whose hospital was close to a specialized rehabilitation center operated by the State department of health. This publicly financed center naturally attracted handicapped patients who might otherwise have gone to the voluntary hospital. Competitive influences of local government were not reported.

Comment and Conclusions

This report of a pilot study of governmental impacts on voluntary hospitals must be taken for what it is, preliminary rather than conclusive. Even so, certain impressions and suggestive ideas emerge.

First of all, it is clear that a great variety of governmental programs are now in operation and are exerting numerous influences on the Nation's voluntary general hospitals. The programs emanate from all political levels—Federal, State, and local—and involve support for

specified beneficiaries, general financial assistance, public regulation, and competitive services.

Second, the overall influence of these programs on the operation of voluntary hospitals is judged by administrators as neutral or beneficial. Negative criticisms are in the minority. Relationships between the hospitals and governmental administrative authorities are, on the whole, good; there seems to be very little evidence of any sense of domination by government.

Third, the quantitative impact of government on the hospital's operation and development appears to be greatest for programs giving general financial assistance, next for programs supporting specified beneficiaries, and least for regulatory programs. The specific beneficiary programs, on the other hand, should perhaps be judged more by their impact on individual patients than on hospital administration per se. The regulatory programs are criticized as often for their weaknesses as for their strengths; their impact is evidently greatly reduced by voluntary standard setting or "accreditation" programs in the same field. One must even suspect that in many, if not all, programs, governmental agencies have leaned over backwards to keep their requirements minimal, even though their mission is manifestly to protect the public welfare.

Fourth, unlike common assumption, the extent of "controls," at least those recognized as restrictive or objectionable, is not related to the extent of money granting authority. The agency that pays the piper is apparently felt to be calling the tune more gently than the one that doesn't. While the overall reaction of hospital administrators, even to regulatory programs, is neutral or slightly favorable, there are more criticisms of the exercise of these authorities than of those associated with grants of money.

Fifth, another common assumption was shaken by the finding of a generally more favorable attitude toward programs emanating from the Federal Government than from State or local authorities. Reactions to all governmental programs were predominantly favorable, but the strongest criticisms related to local government.

Sixth, it appears that administrators of voluntary general hospitals are, on the whole, living contentedly with a great variety of governmental programs, not regarding them as particularly disturbing in one direction or another. There were, indeed, some apprehensions expressed about government, but they nearly always referred to some suspected future, rather than to current or past experiences. In a sense, the overall equanimity of responses was the most significant finding of this pilot study; the minority of negative responses often emerged from second questions rather than coming spontaneously. This is all the more interesting in view of the conduct of this pilot study among voluntary hospitals in upstate New York, a region long known for its conservative attitudes toward government, in general.

Finally, reading between the lines of the responses to the structured interviews, one detects much inadequate understanding of governmental programs and authorities by some administrators. The rules of the game are sometimes not clear, and one suspects that an occasional impression of governmental rigidity comes from a philosophical mind set, rather than from a positive knowledge of governmental policies. On the other hand, with the

great number and the changing character of governmental agencies and programs, it is small wonder that hospital administrators are sometimes not fully informed on all the details. It is trite, perhaps, to point out a need for coordination and streamlining of governmental programs.

These comments must be offered more as impressions than as definitive conclusions. Doubtless they are contrary to the impressions of some persons, although much that is said about the influence of government on voluntary institutions in American life is manifestly based on an a priori ideology and anxiety about the future, rather than on objective observation today. Whether a great extension of governmental impacts on voluntary hospitals in the future would alter the evaluations of administrators is another matter, but it would seem that actual experience has greater prognostic value than speculation. It is our hope to pursue this question with a larger sample of voluntary general hospitals, in various parts of the United States. It is hoped also to explore the impacts of government beyond their perceptions by administrators and down to their measurable consequences in actual hospital operation.

American-Soviet Meeting on Poliomyelitis

A mission selected by the Public Health Service represented the United States at an American-Soviet meeting on poliomyelitis in the Soviet Union May 12 to 16, 1960. The first under the U.S.-U.S.S.R. exchange agreement of November 1959, the mission followed the invitation of the Minister of Health of the U.S.S.R. A similar joint meeting in the United States is scheduled for 1961.

Dr. David E. Price, Assistant Surgeon General of the Public Health Service was personal representative of the Surgeon General and chairman of the United States delegation. Among the members were Dr. Roderick Murray, of the Service's National Institutes of Health; Dr. Alexander Langmuir, of the Pub-

lic Health Service's Communicable Disease Center, Atlanta, Ga.; and Dr. Albert Sabin of Children's Hospital, Research Foundation, Cincinnati, who developed the live poliovirus vaccine now widely used in the Soviet Union. The following topics were discussed:

- Evaluation of the results obtained in mass immunization of the population with live poliomyelitis vaccine from the Sabin strain.
- Report on American activities with reference to live poliovirus vaccine.
- Evaluation of quality control methods for live poliovirus vaccine.
- A program for joint Soviet-American studies on poliomyelitis.

Age, Social, and Demographic Factors in Acceptance of Polio Vaccination

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IN ORDER to find the best means of promoting use of the Salk poliomyelitis vaccine, particularly in age grades where it is most important, the New York State Department of Health sought data on the level of vaccination by age grade within the State and on the social and psychological factors influencing the decision to accept or refuse such vaccination.

In an earlier study, the bureau of epidemiology and communicable disease control of the State department of health had obtained data on poliomyelitis vaccination among all family members of a sample of school children in every county of New York State. Since many families have no school-age children, however, this study gave only a partial picture. For a more comprehensive view with sociocultural and psychological dimensions, a new study was conducted during the spring and summer of 1957 with sampling based on total populations.

Specifically, the objectives were: (a) to provide basic data for estimates of the level of

poliomyelitis vaccination by age grades in the State population, (b) to obtain information on the comparative demographic and social characteristics of vaccinated and nonvaccinated groups, (c) to elicit data on sources of information and other factors connected with decisions to accept or refuse vaccination, and (d) to provide the department with information necessary to plan a comprehensive health education program designed to appeal to those population groups with a low level of vaccination experience.

This paper is concerned with the first two of these objectives and presents the findings on vaccination levels by age, sex, social class, and education. Forthcoming papers will deal with other aspects of the study.

The Study Design

Because of the impossibility of interviewing every family in New York State or, with time and cost limitations, to sample on a statewide basis, it was decided to choose two counties of both rural and urban populations in which to conduct intensive interviewing. The basic methodology was the home interview utilizing a number of diachronic area probability samples in each county. The two counties chosen were Rensselaer County, a semirural county with one large city, Troy, one small city, Rensselaer, and several villages with a large, rural unincorporated area; and Westchester County, an urban and suburban county which adjoins New York City. Westchester

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County differs markedly from Rensselaer County in that it is composed of numerous large cities and many suburban developments with few genuinely rural areas. Within Westchester County, it was decided to exclude the cities of Yonkers, Mount Vernon, and New Rochelle, each of which operates under a separate health department jurisdiction.

The basic plan of the research was to draw for interview an initial sample of 1,000 households in each of the two counties. A schedule of questions sought data on the poliomyelitis vaccination history of each member of the household, sociocultural characteristics of the sample population, attitudes of the respondent toward reasons for individual members of the household and certain other population groups accepting or not accepting vaccination, and the effects of various media of communication in this decision.

The Sample

Sampling in the study reported here was based on physical structures within definite geographic boundaries such as counties, cities, city blocks, or grid overlays on accurate maps. Households within these subareas were selected for the sample, the method varying somewhat between the two counties in adaptation to differences in available population and cartographic data.

This area probability technique was an alternative to the ideal method of listing all households in the counties and randomly selecting the desired interviews from among them. However, available source listings, such as directories and telephone books introduce biases because of selectivity in compilation. Also, time and cost requirements are extensive (1).

The major difficulty in setting up the sample in Rensselaer County was the unavailability of recently published census data on the geographic distribution of the population. The most recent census data by incorporated city or village and by township were 6 years old. While it would have been possible to obtain more recent data in the cities and villages, still left unanswered was the question of the population density of the unincorporated rural area of the county. Fortunately, however, estimated

population figures for this area, considered the most accurate for that county, are maintained by the Rensselaer County Health Department. On the basis of these figures, five subsamples were set up in Rensselaer County in order to allow for equal representation of the various types of areas. Subsample A would be Troy, the largest city in the county; subsample B, Rensselaer City; subsample C, the city of Hoosick Falls; subsample D, the four incorporated villages; and subsample E, the remaining unincorporated areas.

The total estimated population of the county was about 142,000 people, and interviews were allocated according to the proportion in each subsample universe of the total estimated population of the county (table 1). Each type of area required somewhat different procedures for selection of the actual households to be interviewed, but each procedure was based upon proportional representation within the county. When the interviewers actually visited every potential dwelling in the sample, it was found that the actual number of households and the estimates prepared by the staff were virtually the same, never varying more than 1 out of 30 households.

Table 1. Allocation of the sampling interviews in Rensselaer County

Area	Estimated population	Proportion of estimated total population	Number of interviews allocated
Unincorporated area	48,515	34.1	341
Troy	73,768	51.8	518
Rensselaer	11,262	7.9	79
Hoosick Falls	4,451	3.1	31
All other incorporated villages ¹	4,383	3.1	31
Total	142,379	100.0	1,000

¹ Castleton, Nassau, Schaghticoke, and Valley Falls.

The problem in Westchester County was dissimilar to that in Rensselaer County. In Westchester there were definite boundaries established on the basis of census tract lines. The population of these areas was available for the census of 1950, and the Westchester County Planning Commission had just completed an

estimation of the population of the county by census tracts for use in setting up new tract boundaries in the census of 1960. The most serious problem was the absence of any reasonably priced maps of recent vintage for the county. A commercial house in the county had maps which indicated every dwelling unit in the county and which were kept current for use by insurance companies and commercial consumer research groups. The cost of renting the maps for 1 week, however, was slightly more than the amount allocated for the entire project. We were fortunate in that the Westchester County Planning Commission was a subscriber to this map service and allowed the research team to use the maps in its offices. Using the maps, each census tract was delineated and the planning commission's estimated population indicated for each tract.

The total county population in the 150 tracts was estimated at 738,500 by the planning commission as compared with 625,816 enumerated in the census of 1950. Each census tract was assigned a series of consecutive numbers based on the population estimate for the tract in multiples of 1,000. Thus, a tract with 6,000 population was assigned six numbers, a tract with 4,000 population, four numbers, and so on. Multiples above 500 were counted as an additional thousand and an additional number assigned. Thus, if a tract had 5,637 people it was assigned six numbers.

By this method, a total of 417 numbers were assigned to the 92 census tracts in Westchester County exclusive of Mount Vernon, New Rochelle, and Yonkers. Since 1,000 interviews were required, and in order to have as much geographic dispersion as possible within the county, it was decided to select 25 census tracts and to sample 40 households within each of these 25 tracts. The tracts were selected by choosing a random number and then taking every 44th tract until 25 tracts were so selected.

Apartment developments were treated as units and every household within the apartment building was numbered separately. Interviewers were instructed to keep careful records of all households within their 40 household units and to indicate on the map any additional households found or any absent.

In no case was there a disparity of more than

Table 2. Household size and sex distribution of sample and 1950 census populations of Rensselaer and Westchester Counties

Characteristics	Rensselaer County		Westchester County	
	Sample population	1950 census ¹	Sample population	1950 census ¹
Household size -----	3. 3	3. 3	3. 7	3. 4
Sex distribution:				
Males -----	48. 1	49. 2	49. 3	47. 7
Females -----	51. 9	50. 8	50. 7	52. 3

¹ United States Bureau of the Census, 1950 Census of Population, Vol. II: Characteristics of the population, part 32, New York, table 42.

6 households per area, and the average disparity was plus or minus 2 households per 40 unit area.

Interviewing was conducted from April 1 through May 27, 1957, covering 930 households with 3,095 persons in Rensselaer County and 904 households with 3,305 persons in Westchester County.

Following the completion of the interviews there was an attempt to compare the sample population with the general population of the counties in respect to certain demographic characteristics. This was hampered by the lack of recent data on characteristics of the population in both counties. Table 2, however, compares household size and sex distributions of the sample population in each county with the same data for the entire county in the census of 1950, showing a close similarity between the sample population and the general population as described in that year. Other characteristics such as age structure, and occupational and educational structure were also compared. This comparison, while too lengthy for presentation here, once more indicated a close similarity in the demographic structures of the sample population and that of the entire county population.

Findings

The generally accepted belief that women are more health conscious, or at least receive medical care more consistently than men, seems

to be true of poliomyelitis vaccination (tables 3 and 4). At all ages from 10 through 39 years, in both counties, a higher percentage of males than females had failed to be vaccinated. This is true even at the younger ages, but as age increased the disparity between male and female rates of vaccination became greater in both counties, reaching a peak in the 20- to 29-year

age group. Two factors probably contribute to this increased difference in the 20- to 29-year age group. This age group contains the women of childbearing age who were given priority and encouraged to obtain vaccination in the poliomyelitis program. These data also seem to reflect a negative attitude to health safeguards on the part of men in this age group.

Table 3. Inoculation history by age and sex, Rensselaer County

Age groups	Total number		Number of doses							
			None				Three or more			
	Males	Females	Males		Females		Males		Females	
			Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Total	1, 488	1, 607	1, 064	71. 5	1, 091	67. 9	99	6. 7	113	7. 0
0-6 months.....	15	11	13	86. 7	10	90. 9	0	0. 0	0	0. 0
6 months-4 years.....	146	147	28	19. 2	36	24. 5	33	22. 6	42	28. 6
5-9 years.....	152	183	20	13. 2	27	14. 8	36	23. 7	40	21. 9
10-14 years.....	132	131	27	20. 5	26	19. 8	25	18. 9	13	9. 9
15-19 years.....	106	89	69	65. 1	51	57. 3	3	2. 8	6	6. 7
20-29 years.....	166	183	152	91. 6	128	69. 9	0	0. 0	8	4. 4
30-39 years.....	199	217	189	95. 0	176	81. 1	1	0. 5	4	1. 8
40-49 years.....	228	244	224	98. 2	238	97. 5	1	0. 4	0	0. 0
50-59 years.....	183	195	183	100. 0	195	100. 0	0	0. 0	0	0. 0
60 and over.....	149	196	149	100. 0	196	100. 0	0	0. 0	0	0. 0
Not stated.....	12	11	10	83. 3	8	72. 7	0	0. 0	0	0. 0

Table 4. Inoculation history by age and sex, Westchester County

Age groups	Total number		Number of doses							
			None				Three or more			
	Males	Females	Males		Females		Males		Females	
			Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Total	1, 630	1, 675	927	56. 8	902	53. 8	367	22. 6	382	22. 9
0-6 months.....	8	16	8	100. 0	15	93. 8	0	0. 0	0	0. 0
6 months-4 years.....	235	188	22	9. 4	15	8. 0	129	54. 9	107	56. 9
5-9 years.....	173	193	12	6. 9	8	4. 1	115	66. 5	135	69. 9
10-14 years.....	148	111	28	18. 9	14	12. 6	79	53. 4	63	56. 8
15-19 years.....	89	90	41	45. 5	35	38. 9	12	13. 6	20	22. 2
20-29 years.....	158	209	117	74. 1	95	45. 6	6	3. 8	26	12. 4
30-39 years.....	244	274	158	64. 7	159	57. 9	16	6. 6	23	8. 5
40-49 years.....	231	256	207	89. 6	232	90. 6	6	2. 6	5	2. 0
50-59 years.....	178	162	177	99. 4	161	99. 4	0	0. 0	0	0. 0
60 and over.....	138	143	136	98. 5	143	100. 0	0	0. 0	0	0. 0
Not stated.....	28	33	21	75. 0	25	75. 8	4	14. 3	3	9. 1

Table 5. Inoculation history of age groups by social position score, Rensselaer County

Age group and social position score	Total number	Number of doses				Age group and social position score	Total number	Number of doses			
		None		Three or more				None		Three or more	
		Num-ber	Per-cent	Num-ber	Per-cent			Num-ber	Per-cent	Num-ber	Per-cent
<i>6 months-39 years</i>						<i>15-19 years</i>					
Total	1, 851	929	50. 3	211	11. 4	Total	195	120	61. 5	9	4. 6
I	112	30	26. 8	21	18. 7	I	10	3	30. 0	1	10. 0
II	106	35	33. 3	24	22. 9	II	11	7	63. 7	0	0. 0
III	486	230	47. 3	70	14. 4	III	41	27	65. 9	3	7. 3
IV	717	399	55. 6	67	9. 3	IV	84	52	61. 9	4	4. 8
V	424	232	54. 7	28	6. 6	V	48	30	62. 5	1	2. 1
Not stated	8	5	62. 5	1	12. 5	Not stated	1	1	100. 0	0	0. 0
<i>6 months-4 years</i>						<i>20-29 years</i>					
Total	293	64	21. 8	75	25. 6	Total	349	280	80. 2	8	2. 3
I	25	1	4. 0	9	36. 0	I	26	12	46. 2	0	0. 0
II	20	2	10. 0	9	45. 0	II	19	12	63. 2	1	5. 3
III	86	12	14. 0	27	31. 4	III	79	60	75. 9	4	5. 1
IV	102	29	28. 4	25	24. 5	IV	140	121	86. 4	3	2. 1
V	58	19	32. 8	4	6. 9	V	84	74	88. 1	0	0. 0
Not stated	2	1	50. 0	1	50. 0	Not stated	1	1	100. 0	0	0. 0
<i>5-14 years</i>						<i>30-39 years</i>					
Total	598	100	17. 0	114	19. 0	Total	416	365	88. 0	5	1. 2
I	29	3	10. 3	11	37. 9	I	22	11	50. 0	0	0. 0
II	33	1	3. 0	12	36. 4	II	23	13	59. 1	2	9. 1
III	154	20	13. 0	34	22. 1	III	126	111	88. 1	2	1. 6
IV	236	50	21. 2	34	14. 4	IV	155	147	94. 8	1	0. 6
V	144	25	18. 5	23	15. 8	V	88	82	93. 2	0	0. 0
Not stated	2	1	50. 0	0	0. 0	Not stated	2	1	50. 0	0	0. 0

This male-female difference seems to begin as early as 10 years of age in both counties, and, for poliomyelitis vaccination at least, tends to disappear after age 50.

The children from 6 months of age through 14 years of age in both counties generally had quite high inoculation experience. About 75 percent of the children in this age group received at least one injection. As was expected, it was found that the highest level of vaccination experience was in the age group from 5 to 9 years, of which about 85 percent in Rensselaer and almost 95 percent in Westchester County obtained at least one injection.

After age 15 years, the level of injection dropped sharply and decreased consistently through the life cycle so that after age 50 vir-

tually no one had been vaccinated. In the age groups from 15 through 40, when vaccination against poliomyelitis is still a necessary precaution and was so publicized, between 60 and 80 percent in each county had not obtained any injection.

A comparison of the two counties reveals a consistently higher rate of vaccination in Westchester County throughout all age groups. This is probably explained by the fact that Westchester was in the 1954 field trial and Rensselaer was not. In the 1956 and 1957 vaccine programs, moreover, the Rensselaer County Health Department favored a single injection rather than the complete series while Westchester County encouraged the administration of three doses. This difference is re-

flected in our data where a significantly higher proportion of individuals in Westchester County had obtained three or more injections. Equally important is the semirural character of Rensselaer with its older, less educated, and generally lower socioeconomic population than that of Westchester. In fact in all of the characteristics usually associated with higher medical standards, including degree of urbanization, and proximity to metropolitan areas, Westchester is superior to Rensselaer County.

The sample populations in both counties were also classified by social class, using the Hollingshead two-factor index of social position. Each respondent had been asked to identify the chief wage earner in the household and information was obtained on his occupa-

tion and education. This information was weighed individually and then combined to give an "index of social position score." Each member of a household was then assigned to one of five indexes of social position classes, based upon the index score of the chief wage earner of that household.

Most previous studies of poliomyelitis vaccination have found that social class position is one of the most important factors affecting the decision of individuals to be vaccinated (2-6). Such studies have indicated that the higher the socioeconomic status of the individual, the more likely he is to be vaccinated. Our data, without refinement of the samples by age groups, seemed to support this general hypothesis.

Table 6. Inoculation history of age groups by social position score, Westchester County

Age group and social position score	Total number	Number of doses				Age group and social position score	Total number	Number of doses			
		None		Three or more				None		Three or more	
		Number	Per cent	Number	Per cent			Number	Per cent	Number	Per cent
<i>6 months-39 years</i>						<i>15-19 years</i>					
Total	2, 112	704	33. 3	731	34. 6	Total	179	76	42. 5	32	17. 9
I	400	94	23. 5	157	39. 3	I	10	2	20. 0	3	30. 0
II	311	55	17. 7	136	43. 7	II	32	4	12. 5	8	25. 0
III	643	189	29. 4	239	37. 2	III	54	19	35. 2	11	20. 4
IV	517	244	47. 2	149	28. 8	IV	50	29	58. 0	9	18. 0
V	200	108	54. 0	40	20. 0	V	29	21	72. 4	1	3. 4
Not stated	41	14	34. 1	10	24. 4	Not stated	4	1	25. 0	0	0. 0
<i>6 months-4 years</i>						<i>20-29 years</i>					
Total	423	37	8. 7	236	55. 8	Total	367	212	57. 7	32	8. 7
I	113	5	4. 4	65	57. 5	I	54	22	40. 7	5	9. 3
II	58	6	10. 3	35	60. 3	II	36	10	27. 8	8	22. 2
III	129	10	7. 8	80	62. 0	III	113	53	46. 9	13	11. 5
IV	94	13	13. 8	46	48. 9	IV	113	87	77. 0	4	3. 5
V	24	3	12. 5	8	33. 3	V	46	36	78. 3	1	2. 2
Not stated	5	0	0. 0	2	40. 0	Not stated	5	4	80. 0	1	20. 0
<i>5-14 years</i>						<i>30-39 years</i>					
Total	625	62	9. 9	392	62. 7	Total	518	317	61. 2	39	7. 5
I	112	9	8. 0	74	66. 1	I	111	56	50. 5	10	9. 0
II	107	6	5. 6	71	66. 4	II	78	29	37. 2	14	17. 9
III	194	16	8. 2	125	64. 4	III	153	91	59. 5	10	6. 5
IV	136	19	14. 0	87	64. 0	IV	124	96	77. 4	3	2. 4
V	57	10	17. 5	28	49. 1	V	44	38	86. 4	2	4. 5
Not stated	19	2	10. 5	7	6. 8	Not stated	8	7	87. 5	0	0. 0

Table 7. Inoculation history of age groups by education of chief wage earner, Rensselaer County

Age group and education of chief wage earner	Total number	Number of doses				Age group and education of chief wage earner	Total number	Number of doses			
		None		Three or more				None		Three or more	
		Number	Per-cent	Number	Per-cent			Number	Per-cent	Number	Per-cent
<i>6 months-39 years</i>						<i>15-19 years</i>					
Total-----	1,851	929	50.2	211	11.4	Total-----	195	120	61.5	9	4.6
Professional-----	105	34	32.4	23	21.9	Professional-----	9	4	44.4	1	11.1
4 yrs. college-----	102	31	30.4	22	21.6	4 yrs. college-----	9	4	44.4	0	0.0
1-3 yrs. college-----	232	94	40.5	34	14.7	1-3 yrs. college-----	14	7	50.0	2	14.3
High school grad-----	556	289	52.0	59	10.6	High school grad-----	162	38	61.3	3	4.8
Part high school-----	314	172	54.8	35	11.1	Part high school-----	36	26	72.2	3	8.3
7-9 yrs. school-----	440	251	57.0	32	7.3	7-9 yrs. school-----	41	23	56.0	0	0.0
0-6 yrs. school-----	101	57	56.4	6	5.9	0-6 yrs. school-----	23	17	73.9	0	0.0
Not stated-----	1	1	100.0	0	0.0	Not stated-----	1	1	100.0	0	0.0
<i>6 months-4 years</i>						<i>20-29 years</i>					
Total-----	293	64	21.8	75	25.6	Total-----	349	280	80.2	8	2.3
Professional-----	21	3	14.3	11	52.4	Professional-----	20	14	70.0	0	0.0
4 yrs. college-----	26	3	11.5	11	42.3	4 yrs. college-----	20	7	35.0	1	5.0
1-3 yrs. college-----	40	4	10.0	10	25.0	1-3 yrs. college-----	40	30	75.0	3	7.5
High school grad-----	91	18	19.8	22	24.2	High school grad-----	105	81	77.1	3	2.9
Part high school-----	44	10	22.7	11	25.0	Part high school-----	52	43	82.7	1	1.9
7-9 yrs. school-----	62	21	33.9	10	16.1	7-9 yrs. school-----	100	93	93.0	0	0.0
0-6 yrs. school-----	9	5	55.6	0	0.0	0-6 yrs. school-----	12	12	100.0	0	0.0
<i>5-14 years</i>						<i>30-39 years</i>					
Total-----	598	100	16.7	114	19.1	Total-----	416	365	87.7	5	1.2
Professional-----	31	3	9.7	11	35.5	Professional-----	24	10	41.7	0	0.0
4 yrs. college-----	28	4	14.3	8	28.6	4 yrs. college-----	19	13	68.4	2	10.5
1-3 yrs. college-----	83	6	7.2	19	22.9	1-3 yrs. college-----	55	47	85.5	0	0.0
High school grad-----	168	32	19.0	29	17.3	High school grad-----	130	120	92.3	2	1.5
Part high school-----	101	17	16.8	19	18.8	Part high school-----	81	76	93.8	1	1.2
7-9 yrs. school-----	144	28	19.4	22	15.3	7-9 yrs. school-----	93	86	92.5	0	0.0
0-6 yrs. school-----	43	10	23.3	6	14.0	0-6 yrs. school-----	14	13	92.9	0	0.0

An examination of the demographic characteristics of the two counties suggested that more than social class position might be involved. In both counties a significant portion of the sample population was over age 40 and consequently not within the age groups given priority and most encouraged to seek vaccination. Also, social class position is partially related to age since education and occupational advancement both require time. As a result, we felt that it would be more realistic to consider only those individuals who were actively encouraged to seek vaccination. Only those age groups in the 6 months to 39 years range were considered. When the data were reex-

amined by age groups, a somewhat different picture was presented (tables 5 and 6).

In Rensselaer County, where the numbers in the upper two social classes were quite small, the inverse relationship between social class and failure to be vaccinated continued, although the pattern was not so consistent as when viewed apart from age. In Westchester, where the numbers of social classes I and II were considerably larger than in Rensselaer County, class II had a higher rate of vaccination than did class I. In class II, in every age group but the 15 to 19 year category the vaccination process had more often been carried to three or more injections than in class I.

These same age groups had been stratified by the education of the chief wage earner and each grouping compared in terms of vaccination status (tables 7 and 8). Again we found that, in general, as has usually been found in similar studies, the level of vaccination tended to increase with increase in education. In both counties, however, the 4-year college graduates had a generally higher rate of vaccination than did the "professional" individuals, with some postgraduate college education.

Our data appear to show, then, that there is no simple relationship between readiness to obtain vaccination and social class and educa-

tion, that perhaps more than just education and class position are factors in the generally observed improvement in vaccination experience as education and class position increase. One explanation may be that we are dealing with essentially the same people in social class II and education class II since education is an important component in computing social class. Perhaps in both cases we are describing the younger, community-centered college graduate and his family of the upper middle class who have been described by sociologists as "hyperactive in community affairs" and holding "three-fourths of all positions of leadership in

Table 8. Inoculation history of age groups by education of chief wage earner, Westchester County

Age group and education of chief wage earner	Total num- ber	Number of doses				Age group and education of chief wage earner	Total num- ber	Number of doses			
		None		Three or more				None		Three or more	
		Num- ber	Per- cent	Num- ber	Per- cent			Num- ber	Per- cent	Num- ber	Per- cent
6 months-39 years						15-19 years					
Total	2, 112	704	33. 3	731	34. 6	Total	179	76	42. 5	32	17. 9
Professional	428	89	20. 8	162	37. 9	Professional	22	3	13. 6	4	18. 2
4 yrs. college	301	62	20. 6	131	43. 5	4 yrs. college	22	3	13. 6	5	22. 7
1-3 yrs. college	253	84	33. 2	88	34. 8	1-3 yrs. college	22	12	54. 5	3	13. 6
High school grad. .	631	217	34. 4	230	36. 5	High school grad. .	43	15	34. 9	10	23. 3
Part high school. .	162	67	41. 4	50	30. 9	Part high school. .	13	7	53. 8	4	30. 8
7-9 yrs. school. .	227	120	52. 9	51	22. 5	7-9 yrs. school. .	34	22	64. 7	5	14. 7
0-6 yrs. school. .	87	53	60. 9	19	21. 8	0-6 yrs. school. .	19	13	68. 4	1	5. 3
Not stated	23	12	52. 2	0	0. 0	Not stated	4	1	25. 0	0	0. 0
6 months-4 years						20-29 years					
Total	423	37	8. 7	236	55. 8	Total	367	212	57. 8	32	8. 7
Professional	114	8	7. 0	71	62. 3	Professional	70	23	32. 9	9	12. 9
4 yrs. college	65	2	3. 1	37	56. 9	4 yrs. college	35	14	40. 0	8	22. 9
1-3 yrs. college	43	5	11. 6	22	51. 2	1-3 yrs. college	45	22	48. 9	4	8. 9
High school grad. .	134	14	10. 4	82	61. 2	High school grad. .	106	68	64. 2	6	5. 7
Part high school. .	30	2	6. 7	11	36. 7	Part high school. .	31	17	54. 8	3	9. 7
7-9 yrs. school. .	30	5	16. 7	10	33. 3	7-9 yrs. school. .	59	47	79. 7	2	3. 4
0-6 yrs. school. .	5	1	20. 0	3	60. 0	0-6 yrs. school. .	18	18	100. 0	0	0. 0
Not stated	2	0	0. 0	0	0. 0	Not stated	3	3	100. 0	0	0. 0
5-14 years						30-39 years					
Total	625	62	9. 9	392	62. 7	Total	518	317	61. 2	39	7. 5
Professional	110	7	6. 4	71	64. 5	Professional	112	48	42. 9	7	6. 2
4 yrs. college	103	4	3. 9	67	65. 0	4 yrs. college	76	39	51. 3	14	18. 4
1-3 yrs. college	79	6	7. 6	52	65. 8	1-3 yrs. college	64	39	60. 9	7	10. 9
High school grad. .	187	17	9. 1	124	66. 3	High school grad. .	161	103	64. 0	8	5. 0
Part high school. .	46	7	15. 2	31	67. 4	Part high school. .	42	34	81. 0	1	2. 4
7-9 yrs. school. .	67	15	22. 4	33	49. 3	7-9 yrs. school. .	37	31	83. 8	1	2. 7
0-6 yrs. school. .	25	4	16. 0	14	56. 0	0-6 yrs. school. .	20	17	85. 0	1	5. 0
Not stated	8	2	25. 0	0	0. 0	Not stated	6	6	100. 0	0	0. 0

Table 9. Reasons for failure to obtain inoculation, by age, Rensselaer County

Age group	Total number	Too old		Too young		Neglect		Immune		Not necessary for adults		Too expensive	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	2, 155	690	32. 0	34	1. 6	682	31. 6	17	0. 8	262	12. 2	97	4. 5
Under 6 months.....	23	0	0. 0	18	78. 3	4	17. 4	0	0. 0	0	0. 0	0	0. 0
6 months-4 years.....	64	0	0. 0	16	25. 0	28	43. 8	0	0. 0	0	0. 0	10	15. 6
5-9 years.....	47	0	0. 0	0	0. 0	14	29. 8	1	2. 1	0	0. 0	14	29. 8
10-14 years.....	53	0	0. 0	0	0. 0	17	32. 1	3	5. 7	0	0. 0	10	18. 9
15-19 years.....	120	0	0. 0	0	0. 0	61	50. 8	3	2. 5	4	3. 3	10	8. 3
20-29 years.....	280	10	3. 6	0	0. 0	189	67. 5	1	0. 4	29	10. 4	13	4. 6
30-39 years.....	365	25	6. 8	0	0. 0	177	48. 5	5	1. 4	54	14. 8	26	7. 1
40-49 years.....	462	195	42. 2	0	0. 0	104	22. 5	1	0. 2	68	14. 7	11	2. 4
50-59 years.....	378	222	58. 7	0	0. 0	47	12. 4	1	0. 3	58	15. 3	3	0. 8
60 and over.....	345	229	66. 4	0	0. 0	37	10. 7	2	0. 6	48	13. 9	0	0. 0
Not stated.....	18	9	50. 0	0	0. 0	4	22. 2	0	0. 0	1	5. 6	0	0. 0

Age group	Total number	Cutter incident program problems		Vaccine shortage		Don't believe in shots, afraid of needles		Didn't know they were available		Conflicts with other medication		Not stated	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	2, 155	53	2. 5	39	1. 8	92	4. 3	142	6. 6	25	1. 2	22	1. 0
Under 6 months.....	23	0	0. 0	0	0. 0	0	0. 0	0	0. 0	1	4. 3	0	0. 0
6 months-4 years.....	64	1	1. 6	0	0. 0	4	6. 3	1	1. 6	3	4. 7	1	1. 6
5-9 years.....	47	7	14. 9	0	0. 0	7	14. 9	1	2. 1	3	6. 4	0	0. 0
10-14 years.....	53	11	20. 8	1	1. 9	6	11. 3	2	3. 8	3	5. 7	0	0. 0
15-19 years.....	120	7	5. 8	3	2. 5	19	15. 8	7	5. 8	2	1. 7	4	3. 3
20-29 years.....	280	4	1. 4	4	1. 4	9	3. 2	13	4. 6	2	0. 7	6	2. 1
30-39 years.....	365	8	2. 2	17	4. 7	9	2. 5	35	9. 6	4	1. 1	5	1. 4
40-49 years.....	462	9	1. 9	8	1. 7	20	4. 3	41	8. 9	1	0. 2	4	0. 9
50-59 years.....	378	4	1. 1	6	1. 6	10	2. 6	23	6. 1	4	1. 1	0	0. 0
60 and over.....	345	0	0. 0	0	0. 0	8	2. 3	17	4. 9	2	0. 6	2	0. 6
Not stated.....	18	2	11. 1	0	0. 0	0	0. 0	2	11. 1	0	0. 0	0	0. 0

civic organizations" (7). There is considerable evidence among sociologists that it is the "next to the highest" or "striving" social class which becomes involved in community-centered programs rather than the highest social class (8-10).

Another possible explanation is that education beyond a certain point operates to reduce readiness to accept health improvement programs. College graduates and the "striving" upper middle class may not be marked with the cynicism which often seems a part of the value orientation of the highest educational and occupational strata. Whatever the reasons for this difference, the data do seem to suggest that it is the value orientation of a particular

educational or occupational stratum which figures in its readiness to accept vaccination, rather than social class or education alone.

We were also interested in determining why people had failed to receive vaccinations, and so we asked the respondent why each nonvaccinated member of the household had not been vaccinated. Reasons most commonly given were those reported in similar studies (11); advanced age, neglect, forgetfulness, and procrastination (tables 9 and 10). The most frequent reason was "too old" which, if combined with the similar response of "vaccination is not necessary for adults," accounted for about 45 percent of all reasons given in both counties. Here again we wanted to see if certain re-

sponses were more frequent in particular age groups. For example, were those who said they were "too old" actually in the over-age-40 group? Our data show that while "too old" as a reason for failure to obtain vaccination is most commonly given after age 40, a large proportion of the age group from 20 to 39 years of age gave this response again despite the fact that they were the target of vaccination programs.

The reasons centering around apathy or neglect were most frequently given in the 15-29 year age group. In most cases the response was meant to convey the idea that the individual had nevertheless realized he should be vac-

inated. In a separate question we asked the respondent's opinion as to why most teenagers had not been vaccinated. Here the laxity was assigned to the parents; in about 25 percent of the cases in both counties the response was that parents were too lax or disinterested. A later analysis indicated that this reason was given as often by respondents who had teenagers in the household as by those who did not.

The economic and educational differences between the two counties also are reflected in some of the reasons given for nonvaccination. "Too expensive" was given as a reason three times oftener in the less economically developed county of Rensselaer than in Westchester.

Table 10. Reasons for failure to obtain inoculation, by age, Westchester County

Age	Total number	Too old		Too young		Neglect		Not necessary for adults		Too expensive	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	1, 829	676	36. 5	37	2. 1	695	38. 1	167	9. 2	25	1. 3
Under 6 months.....	23	0	0. 0	23	100. 0	0	0	0	0. 0	0	0. 0
6 months-4 years.....	37	0	0. 0	14	39. 5	11	28. 9	0	0. 0	0	0. 0
5-9 years.....	20	0	0. 0	0	0. 0	8	42. 9	0	0. 0	1	4. 8
10-14 years.....	42	1	2. 3	0	0. 0	17	39. 5	0	0. 0	0	0. 0
15-19 years.....	76	1	1. 3	0	0. 0	55	72. 4	2	2. 6	3	3. 9
20-29 years.....	212	4	1. 4	0	0. 0	164	77. 6	15	7. 1	4	1. 9
30-39 years.....	317	25	6. 4	0	0. 0	197	63. 0	35	11. 3	7	2. 3
40-49 years.....	439	221	50. 5	0	0. 0	122	27. 9	46	10. 5	7	1. 4
50-59 years.....	338	214	63. 0	0	0. 0	67	20. 0	35	10. 4	0	0. 0
60 and over.....	279	195	69. 6	0	0. 0	38	13. 8	28	10. 1	2	0. 7
Not stated.....	46	15	30. 0	0	0. 0	16	32. 0	6	12. 0	1	2. 0

Age	Total number	Cutter incident program problems		Vaccine shortage		Don't believe in shots, afraid of needles		Didn't know they were available		Conflicts with other medication		Not stated	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	1, 829	7	0. 4	41	2. 3	76	4. 2	37	2. 0	26	1. 4	42	2. 6
Under 6 months.....	23	0	0. 0	0	0. 0	0	0. 0	0	0. 0	0	0. 0	0	0. 0
6 months-4 years.....	37	1	2. 6	1	2. 6	0	0. 0	0	0. 0	5	13. 2	5	13. 2
5-9 years.....	20	0	0. 0	0	0. 0	4	19. 0	2	9. 5	4	19. 0	1	4. 8
10-14 years.....	42	2	4. 7	1	2. 3	14	32. 6	2	4. 7	3	7. 0	2	7. 0
15-19 years.....	76	1	1. 3	1	1. 3	7	9. 2	0	0. 0	2	2. 6	4	5. 3
20-29 years.....	212	1	0. 5	2	1. 0	7	3. 3	5	2. 4	3	1. 4	7	3. 3
30-39 years.....	317	0	0. 0	18	5. 8	18	5. 8	5	1. 6	6	1. 9	6	1. 9
40-49 years.....	439	2	0. 5	13	3. 0	14	3. 2	6	1. 4	3	0. 7	5	1. 1
50-59 years.....	338	0	0. 0	3	0. 9	6	1. 8	8	2. 4	0	0. 0	5	1. 5
60 and over.....	279	0	0. 0	0	0. 0	5	1. 8	7	2. 5	0	0. 0	4	1. 4
Not stated.....	46	0	0. 0	2	4. 0	1	2. 0	2	4. 0	0	0. 0	3	14. 0

Rensselaer County also had a much higher rate of response for "didn't know they were available" and for reasons associated with the safety of the vaccine such as the Cutter incident. Once again the generally lower educational and cultural level of this county would seem to explain these differences.

Summary and Conclusions

After assigning individuals drawn from two counties by area probability sampling techniques into various age, sex, socioeconomic, and educational strata, we have attempted to find out if there are any differences in poliomyelitis vaccination status which might be related to these characteristics.

Females, even at the younger ages, had a higher rate of vaccination than males, the greatest difference occurring in the age group from 20 to 29 years of age. Our interpretation is that, while it probably reflects the emphasis and priority placed upon the importance of pregnant women being vaccinated, it also represents a masculine resistance to health safeguards, particularly in this age range. This suggests that other health improvement programs must overcome the cultural value which results in the virile young male not seeking health safeguards to the same extent as children or females.

The common belief that poliomyelitis is essentially a children's disease is also reflected in our data, for there is a definite, observable drop in the level of vaccination after age 15 and up to age 40 despite the advertised susceptibility of this age group. Evidently the posters showing child victims and the name "infantile paralysis" have been more effective in establishing attitudes toward contracting the disease than have been the health education techniques designed to encourage vaccination of teenagers and adults to age 40. These findings indicate that it is not enough to tell people that they are in danger of contracting a specific disease. Public health efforts should consider specific motivational factors and the unlearning of established attitudes.

Westchester County, which is socially, economically, and culturally superior to the more rural county of Rensselaer, also had a higher

rate of vaccination at all age levels. This is true not only of first injections but is even more evident in the proportion of individuals who receive three or more injections. Some of this difference is undoubtedly due to the emphasis in the Westchester County program on the necessity of three injections for immunization as contrasted with the single-injection immunity approach in Rensselaer, but the socioeconomic and educational differences between the two counties are also factors.

These differences in participation by members of various social strata are also apparent within each of the two counties. As had been found in most similar studies, the higher the social class position and education, the higher the level of vaccination experience. Our data also indicate, however, that among individuals in the susceptible age range who were encouraged to seek vaccination, it is not the highest social class but rather the second highest which generally showed the highest level of vaccination. Similarly, it was the 4-year college graduate rather than the postcollege graduate group which had the highest vaccination level.

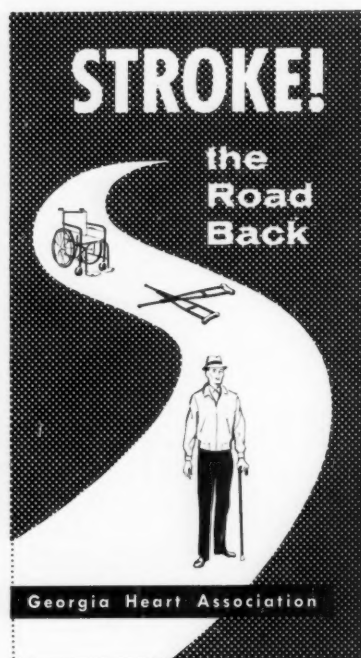
We cannot state definitely that these differences are universal for, while they appeared in both of these dissimilar counties, they may not be true elsewhere. Neither can we be certain that these differences reflect actual differences in behavior, for, while they appear consistently throughout our data, we are dealing with such small numbers in the two highest groups that chance factors may be involved. We believe, however, that they are indicative of the tendency, described by sociologists, of the upper middle class to become more involved in community-centered activities than the less "striving" highest socioeconomic and educational groups. This underscores the hypothesis that it is the value orientation of a particular stratum rather than its ability to pay or educational competence which underlies differences in readiness to participate in health improvement programs.

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Stroke Information In Georgia Leaflet



**HEALTH
EDUCATION
CASE
HISTORY**

"Strike Back at Stroke," the Public Health Service publication used by physicians for prescribing exercises for stroke patients, is featured in a folder published by the Georgia Heart Association in a campaign for assisting stroke victims. Several medical students, engaged by the association to interview physicians about their experience with stroke patients, reported a large proportion, if not a majority, of the physicians were familiar with the publication, "Strike Back at Stroke," and many were enthusiastic about it. They reported no information, however, on the physician's experience with the use of the publication.

Does Better Health Pay?

BURTON A. WEISBROD, Ph.D.

IMPROVED HEALTH is desirable. But so is improved housing, so are improved highways, flood control, recreation facilities, and so on, through an almost interminable list of the things people wish to have. Unfortunately, we cannot have everything we want. We must decide which goods and services to forego as well as which to consume. We must economize—that is, we must get the most from our limited resources. While it is frequently asserted that health and life are moral issues, beyond considerations of cost, it is clear that in our daily behavior we seldom treat them as such. We eat too much, sleep too little, work too hard, and drive too fast. We do so because there are many things we desire, and sometimes, in order to enjoy more of one, we must sacrifice another.

To make choices in a rational manner requires estimation of the relative importance of the various alternatives. If reducing the incidence of disease is more important than building new highways to speed traffic, then, perhaps, a convincing case may be made for increasing health expenditures (and decreasing those on highways). With this general possibility in mind, increasing attention has come to be paid to estimating in money terms the real importance of good health—or, what is the same thing, estimating losses from poor health. (In this paper the terms, “losses from poor health” and “costs of poor health” will be used synonymously.) In many cases, estimates of losses from disease have involved questionable, misleading, or, simply incorrect procedures. It is the objective of this paper to present and analyze exam-

ples of the shortcomings of some attempts to quantify losses attributable to poor health.

Whose Loss

Studies of economic losses attributable to illness have seldom bothered to answer the question, “losses to whom?” Depending on the answer, losses may vary greatly. To illustrate: according to one recent study, the “total cost of tuberculosis” includes compensation payments to “individuals or to their relatives or dependents because of death or disability caused by tuberculosis” (1). Another study includes pensions to tuberculous veterans as a cost, to the United States, of the diseased (2a). To be sure, such payments are “costs” to the givers, but to the entire society they merely represent transfers of money. As such, compensation payments are not costs to the society as a whole any more than payment of an allowance by a father to his son is a cost to the family, though it is a cost to the father.

What is fundamentally involved here is the distinction between real costs and transfer payments. From the point of view of the entire society, real costs exist to the extent that resources (natural, capital, human) are used up. Of course, we may measure the value of the resources used as X dollars; but while the dollars measure the cost, the real cost is the resource which was used up.

On the other hand, if person A merely makes a payment (be it called gift, subsidy, compensation, or transfer) to B, no resources are used up in the process. Thus, we see that costs, real costs, that is, and money expenditures are not synonymous terms. There may be expenditures without real, or social, costs. And there may be

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social costs without expenditures. This will be discussed below.

Failure to recognize both of these possibilities is a common source of error. Compensation payments are unilateral transfers of funds, and, as such, do not represent resources used. They do represent the value of resources changing hands, but there are no fewer resources available to the society after the payment than there were before. Thus, the payments (expenditures) do not represent real costs to society.

Costs Without Expenditures

Although it is apparent that all expenditures do not represent real costs for the society as a whole, it is less obvious that there may be costs even though there are no expenditures. Social costs not reflected by expenditures take a number of forms.

Direct Production Loss

"Tuberculosis: Why Not Get Rid of It?" is the question raised in one study (2a). Statistical evidence was offered to demonstrate the good return which would result were tuberculosis eradicated in the United States. But the case was weakened by the omission of the value of production lost because of morbidity and mortality caused by tuberculosis. This loss is no less real nor less important than the losses which were reflected by payments of money—care of the ill, casefinding, and medical research.

Production lost as a result of disease is almost as difficult to measure as it is important. In particular is this true for housewives' production. While earnings of men may be reasonable estimates of the value of their contributions to output, there is no equally useful measure available of the value of household services performed by housewives. I have recently attempted, in a tentative manner, to place a value on household production by women at various ages (3a). Another author, Fein, recognized his failure to consider the matter, but explained the omission on grounds of the difficulty involved (4).

In rationalizing his exclusion of the value of housewives' services, Fein points out that they are also excluded from our national income and

product accounts. This is correct, though the reason for the exclusion is, again, the practical difficulty of measurement; at the conceptual level it is clear that household production should be counted as part of total national production.

Regardless of whether the production lost is owing to mortality of males or of females, there is further the question of whether the loss should be considered net of consumption, or as gross (total) production lost. There is no correct choice! Using gross production (earnings) lost has the practical advantages of requiring fewer computations and making unnecessary the estimation of "consumption." On the conceptual level, the issue is, namely, when we measure losses, whose losses are we concerned with? The production lost to the entire population (setting aside other forms of loss) when a person dies is the total of whatever he would have produced; the production lost to the surviving population, rather than the entire population, is the value of whatever he would have produced minus the value of what he would have consumed. It is this difference which is lost to the remainder of society. The latter approach would, of course, show a smaller loss than the former. If a good case can be made for increasing expenditures on control of a disease using net figures, then, a fortiori, a good case for increasing expenditures could be made if the gross production-loss figures were used. Fein (4) used the "gross loss" approach; the "net loss" approach, in different forms, was used by Reynolds (5) and Weisbrod (3).

Indirect Losses

Disease causes at least several other forms of real social losses which, because they are not reflected by money expenditures, are often overlooked. They are complex, and the absence of money expenditures has made appraisal of their impact difficult. By no means does this imply that they are quantitatively insignificant.

One is the indirect effect of sickness on the productivity of the healthy. Temporary absence from work (much of which results from illness) necessitates certain adjustments of the production process which make the total cost of illness greater than the cost to the ailing worker. In an economy of widespread special-

ization and division of labor, the absence of one worker may drastically reduce the productivity of others. Further, uncertainty regarding the daily volume of absences creates for many firms the necessity of employing extra, standby workers who, on days when the rate of absenteeism is low, will not be needed, and will contribute little to output.

Another commonly overlooked form of loss from disease is what we may term "avoidance costs." Even were there no cases of some disease, it would not necessarily be a valid inference that the social losses from that disease were zero. It might be that the incidence was being held down by the taking of costly steps to avoid it.

Where environmental conditions contribute to a disease such as malaria, avoidance costs may go undetected. On the island of Sardinia, where malaria had been endemic until the recent mosquito-eradication program, many farmers adjusted to the threat of malaria by living as much as an hour's walk from their farms. The fertile farmlands were located near swampy, mosquito-breeding areas; the mosquitoes were not troublesome during the day, when the fields were being worked, but the mosquitoes rose at dusk, and so it was not healthful to live near the fields. In this example, the avoidance cost attributable to malaria was the unproductive time and effort devoted to commuting (3*b*).

Demographic Factors

Disease affects the size and composition of the population with respect to age, sex, and location through effects on mortality. Economic effects of a children's disease may differ substantially from those of a disease which primarily affects persons of middle and old age. Such matters as the consequences for living standards of (a) variation in proportion of the population in the labor force, and (b) change in the absolute size of the labor force (relative to the supply of land and capital resources) are relevant to a complete identification of the social consequences of disease.

The difficulties of dealing with many of these factors are substantial. But, while one may be forgiven for not delving deeply into the quantitative aspects of population change,

avoidance costs, and absenteeism, he cannot be excused for failing to recognize their relevance in any estimate of the magnitude of social losses from illness.

An additional real cost component which ought not be overlooked, although we can do little more than mention it, is an affliction's intangible, emotional effect on friends and family as well as on the patient himself. It is a mistake, however, to conclude, as a number of writers have, that these effects take the matter of determining the appropriate level of health expenditures out of the realm of economic analysis. It is easy to say: "We have the knowledge and the necessary resources for the control of disease. Obviously, we must put our knowledge to work" (6). We also have the knowledge and resources to eliminate malnutrition, to abolish slums, to greatly improve education—but we do not have the resources to do everything we like. Thus a choice becomes unavoidable: we choose which things we will accomplish (and which we will not). Calling health a moral issue does not alter this necessity of an economic choice.

Measuring Direct Expenditures

Even if one identifies those losses (costs) attributable to disease which do not involve direct expenditures of money, and even after it is clear what forms the real costs of illness may take, there remain thorny tasks of measurement. Discussing the cost of a mass X-ray program of disease detection, one study reported, in 1947, an estimated "... cost of 25 cents a film for each person X-rayed ..." (2*b*). This figure appeared to represent the out-of-pocket (marginal) cost of X-raying a person, once the equipment and personnel were available. However, the large increase in the X-ray program proposed in the study would require considerable additional equipment and workers; hence, the cost of X-raying would include a portion of the cost of securing the necessary extra machinery and labor, as well as the cost of the film and its processing. If the 25-cent figure did represent only the out-of-pocket cost of the film, its processing and handling, it seriously understated the extra costs which would be incurred were the tuberculosis eradication

campaign, with its 20 million X-rays per year, to be carried out.

Conclusion

In this paper I have attempted to catalog factors to consider in discussions of losses from illness and costs of improving health. Three general points are stated.

- Expenditures do not always represent real costs to society.

- Even where there are no expenditures, there may be real costs to society.

- Expanding health and medical facilities may frequently increase unit costs.

To increase expenditures for public health may well be good business, but the economics employed in arguing the case can be strengthened. Sound economic analysis will have a greater cogency in the original statement, and the subsequent experience will be more likely

to earn respect for the acumen of the health official, as predictions prove accurate.

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Status of Fluoridation in Community Water Supplies

At the close of 1959, some 1,878 communities, supplied by 1,048 water systems, had adopted fluoridation to help reduce the heavy national burden of dental decay. In these communities, there are 36,199,047 people receiving the benefits of this health measure.

During 1959, 77 communities with a total population of 806,880 adopted fluoridation. The majority of this number was made up of small cities and towns scattered throughout the country. However, considering that 93 percent of all communities are 10,000 or less in population size, a great many small cities and towns do not have fluoridation. By the end of 1959, the percentage of all communities that had adopted fluoridation was as follows: population over 500,000, 61 percent; 500,000-100,000, 35 percent; 100,000-10,000, 34 percent; and under 10,000, 8 percent.

Of the estimated 118 million people in the United States provided water from community supplies, 43 million drink water containing at least 0.7 parts per million of fluoride. Of these 43 million persons, 36,199,047 are supplied water containing fluoride concentrations adjusted for optimum dental benefits; and 7 million people use water naturally containing 0.7 parts per million or more fluoride.

A charter member of the American College of Preventive Medicine calls upon his colleagues to take a more active interest in the control of industrial forces damaging to public health.

The Occupational Health Challenge to Preventive Medicine

HUNTINGTON WILLIAMS, M.D., Dr.P.H.

IT IS a satisfaction to note that our American College of Preventive Medicine is now 5 years old. Our distinguished roster of members includes a fair number of top administrative physicians in State and local health departments and an occasional industrial hygienist who have played their part in providing health protection for sizable groups of employed persons whether in mine, mill, factory, on a farm, or in an office.

But most of our members must feel that they are remote from any responsibility in this field of endeavor. And it is to them that I would prefer to address my chief emphasis in these remarks.

Our college members who are not industrial hygienists per se have a need to feel that they can and should play an important role in the occupational health needs of their own State or locality.

How well is this work being done in your area? Is it getting enough in the budget? Is there enthusiasm for it at the top level? Would not its chief administrator welcome some support and encouragement from you? Remember that not many years ago very little was being done, and the successful programs of today began pretty much on a shoestring. Does this seem unexciting, or are you too busy with your own work? Is adult health protection less im-

portant than a school health program? What about air pollution control, or radiological health protection, or lead paint poisoning among 2-year-olds in the slums? You might be surprised to find that the man in charge would welcome some show of interest from you. You have a part to play if you are really interested in preventive medicine.

Dr. James M. Mackintosh of London, writing on trends of opinion about public health in England during the first 50 years of this century, said: "One broad feature which forms a background to the whole 50 years may be mentioned at this point; everyone says that prevention is better than cure, and hardly anyone acts as if he believes it, whether he is attached to Parliament, central or local government, or the commonalty of citizens. Palliatives nearly always take precedence over prevention, and our health services today are too heavily loaded with salvage. Treatment—the attempt to heal the sick—is more tangible, more exciting, and more immediately rewarding, than prevention."

Some 3 years ago, Sir Allen Daley, formerly medical officer of health, London County Council, and I presented a paper on "Public Health Practice: An Ounce of Prevention Is Worth a Pound of Cure," in which we quoted Dr. Mackintosh's statement (1). We asserted then that "if the health department [and for the moment you are all included in the health department] does not pay prime attention to prevention and avoid spending too much of its energy on administering curative medical services, no other agency in government will cultivate the great

Dr. Williams, commissioner of health, Baltimore, Md., presented this paper before the American College of Preventive Medicine at the 87th annual meeting of the American Public Health Association, Atlantic City, N.J., October 22, 1959.

untilled fields of preventive medicine." And we questioned whether the warning voiced by Dr. Mackintosh would be heeded.

We then discussed in some detail four untilled or partially tilled fields of prevention: mental hygiene, industrial hygiene, air pollution, and health education. Surely you will all agree that industrial hygiene or occupational health is a most important area of preventive medicine. Whatever your own major field of endeavor, you can play a part in improving the occupational health status of your community, if you will let yourself become intrigued a bit about it.

In many State health departments and in a number of the larger city health departments in the United States, a fair amount of inspection, abatement, and control service is done in protecting the health of industrial workers, but not nearly as much as could and should be done. As an example, in Baltimore, a city of about 986,000 persons, there is a lively program that has been built up over more than 30 years into a bureau of industrial hygiene and its specialized staff. This staff of 15 is made up of a highly qualified physician, Dr. R. R. Sayers, formerly in charge of all this work in the Public Health Service, 2 chemical engineers and 2 civil engineers, 2 expert laboratory chemists, 5 special inspectors, a public health nurse, and 2 stenographers.

The Baltimore City Health Department in the 1920's was called on to investigate complaints and occasional known cases of occupational disease. In 1925, the city passed a strong gas appliance ordinance and placed responsibility for its enforcement with the health department. There had been too many deaths from faulty gas equipment and tubing. A State law later made it mandatory for physicians to report all cases of occupational disease to the local health department which, in turn, was directed to study and control such causes of death or illness and adopt regulations for their prevention.

At first, plant management was skeptical of visits from the health department, but, little by little, confidence was established and real service was provided on a consultation basis. Today one plant's manager tells another to call for this highly qualified and protective guidance. The local medical profession has aided

greatly in developing this spirit of teamwork. Local industrial leaders of top rank in Baltimore now expect the city health department to concern itself with these matters. In fact, their Association of Commerce has established special health committees for self-policing and for co-operative health activities. The commissioner of health and his staff serve on these committees in an ex officio capacity.

Technical Studies

In 1958, among 56 technical studies made of toxic materials used in Baltimore industries, 8 may be mentioned as characteristic.

Foundry studies. Dust studies were made in five nonferrous foundries. The dust counts ranged from 1.5×10^6 to 19.7×10^6 particles per cubic foot of air. The sand preparation and the shakeout operation areas were indicated as needing attention. Management was notified to supply approved respirators for employees in dusty areas, to maintain and check the functioning of exhaust systems, and to minimize dust on floors traversed by mobile equipment. These suggestions were carried out.

Mercury float bed. Upon request, a "mercury float bed," located at the ballistocardiographic laboratory of a large hospital, was investigated for possible emission of mercury vapor. The patients lie on an aluminum tray which floats on the mercury. The motion of the tray, caused by blood flow and breathing, is measured, and electrocardiograms and phonograph records of the heartbeat are taken. Patients do not come in contact with the mercury, which has a silicone oil film to reduce vaporization. The study revealed the presence of mercury in the trap of a sink located in the room. The removal of a few cubic centimeters of mercury from the trap and additional cleanup procedures corrected the condition.

Radiation control. Investigation of 45 radio-isotope users revealed that the isotopes are used in the medical field for research, diagnosis, and treatment; in the industrial field for radiography and density gauge measurements; and in the educational field for research. In general, all users were found to be handling the isotopes safely, except for an occasional deviation from Atomic Energy Commission require-

ments, chiefly in regard to the proper posting of "hot areas" or the keeping of records. These conditions were corrected.

At the request of the Baltimore Department of Public Works, the health department began monthly monitoring of the radiation activity of the three city sources of water supply and the effluents of the two sewage disposal plants. Like the earlier air monitoring, these new checks are to establish baselines of information. These services will be continued.

Shoe-fitting machines. City Ordinance No. 1518, approved June 25, 1958, prohibits any person from maintaining or operating in Baltimore any fitting devices or machines which use fluoroscopic, X-ray, or radiation principles, for the purpose of fitting shoes in connection with the sale of footwear. Inspection revealed that all shoe-fitting machines were removed, or 45 machines from 43 shoe stores, attaining complete compliance.

Lead and silversmithing. A survey was conducted at two local silversmithing plants after a lead hazard was discovered in the Massachusetts silversmithing industry. Samples of dust from the sand-bobbing operation indicated no significant employee exposure to lead.

Formaldehyde eye irritation. Employees of two clothing stores complained of eye irritation. As in previous years, investigation showed that these irritations, which occur during warm weather, were caused by dust from cloth treated at the mills with a formaldehyde preparation in order to make the material wrinkle and shrink resistant. Installation of exhaust ventilation removed the cause of the eye irritation.

Court actions. During the year, court action was instituted against the owner of a drycleaning establishment who failed to provide adequate controls to prevent industrial surface drainage, and against the owner of an automobile repair garage who failed to provide adequate exhaust ventilation. Corrections were made in both instances.

Firefighters and carbon monoxide. Firefighters became ill while battling a blaze at a chemical plant, and the bureau was requested to investigate since there was speculation that the fire created hazardous airborne chemicals. It was apparent that the fire started in an air-

locked enclosure where paper bags and an inert ore, manganese dioxide, were stored. Combustion of the paper in the oxygen-starved air formed carbon monoxide. A sample of ore removed from the fire area showed that sufficient gas had been adsorbed by its surface to give a positive reaction for carbon monoxide.

Planning for the Future

Closely related to industrial hygiene and the prevention of the occupational diseases is the equally interesting and persistent present-day challenge of air pollution. Health departments long ago concerned themselves with the disposal of solid wastes and, more recently, with liquid wastes. How long will the public be content to watch the health officer in an industrial area sit by and take no part in the control of the purity of the air the citizen must breathe?

Let us look at a riverside industrial city that backed away from the problem of air pollution, or rather, did not approach it at all. A group of new industries moved into this community. For local, nearsighted, fiscal, and other reasons, the new plants were located directly to windward of the residential areas. The city officials soon knew and the whole city knew that they had not planned and built properly. Rather they had created for themselves the curative and expensive task of air pollution control, a task that could and should have been prevented. This is an aspect of town planning which does not always receive the attention it deserves.

Granted that these industrial controls constitute a difficult task; but what a challenge it is to preventive medicine and how rewarding you will find it if you let your interest increase and you become a part of it.

The technical studies are described in detail in the 1958 annual report by Charles E. Couchman, director of the Baltimore Bureau of Industrial Hygiene. The annual report is available upon request.

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Civil Defense Emergency Hospital



Civil defense emergency hospitals, austere but functionally complete, are stored in strategic locations throughout the United States. Equipment is packed in 351 boxes which fit in a standard moving van.

In a demonstration of civil defense training techniques, 40 employees of the Metropolitan Life Insurance Co. set up a 50-bed emergency hospital in the auditorium of the firm's New York office. After only a preliminary briefing, the casualty aid unit unpacked 95 boxes and set up the hospital equipment in 1 hour and 15 minutes and repacked the items in 45 minutes.

The complete hospital consists of an admitting-triage area, shock ward, operating rooms, pharmacy, laboratory, central supply section with sterilization facilities powered by gasoline or bottled gas, generator, and X-ray machine with polaroid development process.

The demonstration, held March 8, 1960, with the assistance and guidance of the training branch staff, Division of Health Mobilization, Public Health Service, was a field test to orient personnel to the hospital prior to its use in the division's training courses.

The first course, "Medical Aspects of Health Mobilization," was offered April 18-23, 1960, at the eastern instructor center, Office of Civil Defense Mobilization, Brooklyn, N.Y. Its purpose was to bring up-to-date disaster information and training to a nucleus of professional personnel concerned with medical and health needs of the civilian population in an emergency. Students were 104 physicians, dentists, nurses, and veterinarians from government, private industry, and the Armed Forces.

Two similar courses were given May 8-13 at the OCDM Staff College, Battle Creek, Mich., and June 5-10 at the OCDM western instructors training center, Alameda, Calif., for civil defense directors and personnel in planning, operational training, and supervisory activities in health and medical services aspects of civil defense.

The Work of Selwyn D. Collins

Selwyn D. Collins was a pioneer in the collection and analysis of statistical information on the health status of the general population. He created not only an important body of new statistics about the common human ailments but also new techniques for obtaining such statistics, new terminology for describing them, and new methods for analyzing them.

Almost all of Dr. Collins' working life was devoted to quiet, unostentatious research in his chosen field of interest. In 1920, his first position in the Public Health Service was that of statistician on the staff of Edgar Sydenstricker, one of this country's foremost epidemiologists. Mr. Sydenstricker and Dr. Goldberger had been using interviews to show the statistical association between pellagra and dietary deficiency in the classic South Carolina Mill Villages Study. It was undoubtedly Sydenstricker's use of community interview surveys of the general population that stimulated Dr. Collins' interest in this method.

During this early period Dr. Collins also had close and frequent contact with Dr. Wade Hampton Frost, an outstanding epidemiologist and an associate of Sydenstricker. Dr. Frost influenced the character of many Public Health Service studies, while Dr. Collins improved the techniques for such studies and carried them to new heights of usefulness.

Dr. Collins' contributions to methodology are seen in two comprehensive health surveys of national scope and numerous smaller intensive community surveys. The survey by the Committee on the Costs of Medical Care in 1928-31 and the National Health Survey of 1935-36 were more ambitious than anything of their kind previously undertaken in this country. They were based on cross sections of the population, using methods of sampling that were advanced for their time. The community study in which the health and medical care of a

population is analyzed over a period of time was of particular interest to Dr. Collins, and he played an important part in the designing of such studies as those conducted in Cattaraugus County and Syracuse, N.Y., and the 5-year survey of the Eastern Health District of Baltimore.

It was in his methods of analyzing the complex mass of data obtained in these surveys that Dr. Collins' ability was most evident. The soundness of these methods is indicated by the large number of them that have been adopted for use in later surveys, including the U.S.

Public Health Monograph No. 62

Selwyn D. Collins' Contributions to Health Statistics: A Guide to His Works. By Maryland Y. Pennell, Theodore D. Woolsey, Katharine S. Trantham, and Josephine L. Lehmann. Public Health Monograph No. 62 (PHS Pub. No. 737), 14 pages, U.S. Government Printing Office, Washington, D.C., 1960, 20 cents.

The accompanying text is the introduction to the grouping of Dr. Collins' publications into the 11 categories which form the principal contents of Public Health Monograph No. 62, published concurrently with this issue of *Public Health Reports*. This monograph is the joint work of four persons who served under Dr. Collins in the Division of Public Health Methods and are still in that division of the Public Health Service.

For readers wishing the data in full, copies are on sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. Official agencies and others directly concerned may obtain single sample copies without charge from the Public Inquiries Branch, Office of Information, Public Health Service. Copies will be found also in the libraries of professional schools and the major universities and in selected public libraries.

National Health Survey which began 3 years before Dr. Collins' death. Into the very foundations of this major endeavor to fill permanently the need for comprehensive morbidity statistics has been built much of Dr. Collins' methodological framework.

But Dr. Collins was more than a specialist in illness survey methods. Perhaps his greatest contribution to public health was the series of papers in which he and his co-workers published the statistical results they had compiled. These papers represent source material which will be consulted for decades to come.

The significance of this body of data on general morbidity and medical care utilization is that it marks a turning point in demography. Much of the knowledge available to public health workers on the volume and distribution of illness and injury had previously come from mortality statistics. As medical science advanced, however, death became regarded more and more as the end point of a long complex of illnesses and increasing disability. Mortality statistics no longer gave an adequate description of the health needs of society. Although it will be years before public health statistics on morbidity are as periodic, detailed, and reliable as those on mortality, Dr. Collins'

lifetime of work has brought that attainment nearer.

Of his many achievements in the compilation of illness and medical care data and the development of health study techniques, a few examples follow:

1. Collaboration in developing international uniformity in classifying causes of morbidity and mortality. This resulted in the extensive sixth revision of previous international lists which, in 1948, became the International Statistical Classification of Diseases, Injuries, and Causes of Death.

2. Contribution to the difficult and controversial question of the relationship between economic status and health, and particularly the effect of the depression of the 1930's upon health.

3. Analysis of a long series of influenza epidemics in the United States, demonstrating the changing character of these epidemics and the effect they had on mortality from diseases other than influenza.

4. Origination of methods for the use of school health records to depict statistically the health of children and, in particular, for finding ways of circumventing the shortcomings of these records.

Foreign Science Literature

The National Science Foundation has designed an exhibit to acquaint U.S. scientists and technologists with current translations from Russian scientific literature and their availability.

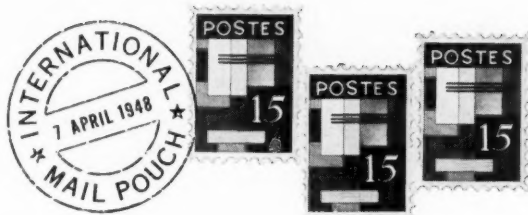
Sample copies selected from some 85 available Russian journals which have been translated cover-to-cover are featured. These journals are representative of leading Soviet publications in the disciplines of agriculture, astronomy, biology, chemistry, earth sciences, engineering and technology, mathematics, medicine, physics, and social sciences.

Handout pamphlets, provided to exhibitors without charge, contain information on translation depository libraries in the United States and bibliographic periodicals which list new

accessions and abstract translations. The pamphlets also list translated Russian journals by discipline, as well as other pertinent information.

A foldup book display, this compact exhibit opens like a suitcase, is completely self-contained, and can be installed quickly and easily. Complete instructions are included.

The exhibit is available on loan to professional and academic groups for 2-week periods, unless otherwise specified. There is no charge. Requesters should include alternative dates, complete shipping address, and anticipated number of viewers. Address all requests and inquiries to the Office of Science Information, National Science Foundation, Washington 25, D.C.



Progress in the "Outback"

In the Northern Territory of Australia, 15,000 members of once primitive tribes, until recently threatened with extinction, are multiplying on cattle stations, missions, and settlements scattered over the almost roadless half million square miles of the territory. The total population is only 35,000.

To cope with medical emergencies and public health needs for this thinly settled territory, the Commonwealth Department of Health flies physicians, dentists, dietitians, nurses, health inspectors, and aboriginal health assistants to settlements by its aerial ambulance service. Physicians travel the circuit once a month by three different routes, covering the greater part of the Northern Territory. Each circuit takes about 3 days, with stops at three or four places each day, for "sick parade." Patients who need further investigation or treatment are brought to Darwin by the service's plane, commercial aircraft, truck, or mission lugger. Dentists travel the same circuits but at less frequent intervals.

Physicians, dentists, and other health personnel doing survey work also travel by air. They may spend weeks at one settlement, screening all persons, carrying out immunization campaigns, or instructing and advising on sanitation, nutrition, or personal hygiene.

Each mission or settlement has at least one trained nurse to handle daily medical needs and to supervise infant welfare. The nurse is responsible to the visiting physicians for carrying out prescribed treatment. She also radios for assistance in emergencies.

It is planned that each settlement will have an aboriginal assistant. The skill of these young men with a microscope has been an important asset in combating hookworm, leprosy, and tuberculosis.

Leprosy, which once had an estimated incidence

of 5.6 percent, is now decreasing although the infection persists in remote and inaccessible areas. Yaws and granuloma have decreased considerably. Malaria is confined to small areas, in a mild vivax form.

Trachoma is severe in the dry inland areas of the Northern Territory. An ophthalmologist is now organizing treatment and prevention. Tuberculosis is not so prevalent as it is among some native communities, and an organized campaign of chest X-rays and treatment is being carried out. Pertussis and measles have been prevented by inoculation. With improvement of diet, potbellied and rachitic children are no longer a common sight. The infant mortality rate is decreasing.

In their tribal state, Australia's aborigines were remarkably free of the communicable diseases common in the tropics. Intertribal barriers, which were in effect isolation practices, protected them. Each tribe, never larger than 300 persons, lived self-contained within its own lands and even at yearly corroborees with other tribes, preserved its own separate camp. Within the tribal lands, these people were seminomadic. They lived by the spear and moved from one water hole to another when game became scarce. Their high protein, low carbohydrate diet (mostly meat with various roots, berries, and yams) was a little deficient in calcium and vitamin C by modern standards, but they showed no evidence of deficiency.

As the tribesmen took jobs at cattle stations as stockmen, and in towns, missions, and government settlements, they came into contact with infectious agents. Also, once they exhausted the local supply of game, they had little to eat but carbohydrates. Frank kwashiorkor was rare, but lesser degrees were usual among children. Pertussis and measles took a heavy toll. Fecal customs, unimportant in a seminomadic life, led to epidemics of dysentery in the camps, and hookworm and other worm infestations became prevalent.

—Excerpted and adapted from A. H. Humphry, M.B., B.S., D.T.M.&H., chief medical officer, Office of the High Commissioner for Australia, "The Australian Aborigine and the Flying Public Health Doctor." *Journal of the Royal Institute of Public Health and Hygiene*, 22: 291-294, December 1959.

Signs

and

Symptoms

Extremely hot weather is associated with a higher death rate than very cold weather, according to data from 1949 through 1958. Paul H. Kutschenreuter, U.S. Weather Bureau meteorologist, reported these findings at a meeting of the District of Columbia section of the American Society of Heating, Ventilating, and Air Conditioning Engineers.

The increase in deaths during a frigid spell is relatively small compared with what happens during a heat wave, he said. Hot weather deaths are sometimes triple the normal number for the season. The elderly are the hardest hit; the death rates of persons aged from 1 year through 24 years seem unaffected by either heat waves or cold spells.

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Americans under 20 years of age will number 90 million, 40 percent of the population, by 1970. Those over 65 years of age then will number about 21 million, more than 10 percent.

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A "disaster city" is being opened in Pasadena, Calif., for use as an emergency civil defense or alternate local government headquarters. The main building contains a large auditorium, office space, classrooms, a modern kitchen, and nurses' quarters. An estimated 10,000 refugees could be housed in tents on the grounds and fed from the kitchen facilities.

A "disaster street" is under construction to be used as a training area for civil defense personnel and for testing rescue, monitoring, and first-aid conditions.

The installation will serve also as a full-time police academy and will be available to the public for selected civic projects.

Safety information for baby sitters is being encouraged through local campaigns by the Florida State Board of Health in cooperation with the National Safety Council. Local health officers and other interested persons are receiving a packet containing a planning guide which suggests community courses in safety for baby sitters, leaflets for parents, and the basic informational needs of sitters.

« »

The mortality rate of mothers in Minnesota is approaching what might be considered an irreducible minimum, according to Dr. J. L. McKelvey, head of the department of obstetrics and gynecology of the University of Minnesota Hospitals, reporting on the Minnesota Maternity Mortality Study conducted since 1941 by a special subcommittee of the Minnesota State Medical Association. Minnesota's 1957 rate for obstetric deaths was 0.24 per 1,000 births, only slightly higher than the 0.2 per 1,000 usually considered to be the rational lower limit of maternal deaths.

« »

The U.S. Air Force is pursuing a medical survey of personnel exposed to microwaves to determine possible harmful effects. There has been evidence that microwaves form cataracts.

For some time, the suspected harmful effects were ascribed exclusively to "overheating" of tissues. But new data from several research centers strongly hint at more subtle and as yet little-understood non-thermal effects.

When influenced by microwaves, protozoa that normally move in a seemingly helter-skelter fashion suddenly march in orderly procession, Dr. John H. Heller of the New Eng-

land Institute of Medical Research reports. He emphasizes that effects on living cells are tied directly to the electromagnetic field, with very little leeway. Amebas, he states, which merely shift their line of march with changing exposures in the range of a few microseconds, may be "literally ripped to shreds" by fields lasting half again as long.

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The role of public health workers in accident prevention has been set forth by the Mississippi State Board of Health in an 11-page mimeographed pamphlet available upon request.

Full integration of accident prevention techniques into every existing health program of a local department is advocated. And emphasis is given to the need for encouraging community support and participation.

State and local health officers, public health nurses, sanitation personnel, health educators, nutritionists, communicable disease investigators, and clerks are given tips on ways to underscore good safety practices in the community while performing their duties.

« »

A joint liaison committee of epidemiologists and laboratory directors has been named by the Conference of State Epidemiologists and the Association of State Public Health Laboratory Directors. Dr. Elmer L. Shaffer of New Jersey has been appointed as chairman for 1960. The chairmanship will alternate each year between a laboratory director and an epidemiologist.

« »

Beginning in 1961, an estimated 200,000 Pennsylvania drivers who were licensed prior to 1924 will be required to submit a certificate from a physician and a State police examiner testifying that they meet minimum physical standards. And beginning in 1962, all drivers will be required to supply proof of a satisfactory physical re-examination every 10 years up to the age of 60, and every 5 years thereafter.

Federal Publications

Indians on Federal Reservations in the United States. A digest. Albuquerque Area. *PHS Publication No. 615, pt. 4; 1960; 34 pages.*

Selected information is presented on Indian groups in Colorado and New Mexico and portions of Arizona and Utah. The population groups, their homes, education, and income sources, and their health status and services are discussed. Included also are brief descriptions of the location, ownership, and topography of reservation land.

Health Statistics From the U.S. National Health Survey.

Chronic respiratory conditions reported in interviews, United States, July 1957-June 1958. *PHS Publication No. 584-B12; 1959; 32 pages; 30 cents.*

For four diagnostic categories—asthma and hay fever, chronic bronchitis, chronic sinusitis, and other chronic respiratory conditions exclusive of tuberculosis—detailed tables give numbers and rates for the condition, medical attention status, and associated restricted activity and bed disability days.

Findings of previous surveys and estimates made by researchers in the health field are cited to provide a background for these first data on chronic respiratory conditions from the National Health Survey's household interview. To the extent that they are available, results of medical record and examination studies of these diseases are also presented; and they show how differing concepts of morbidity affect the magnitude of prevalence estimates.

Heart conditions and high blood pressure reported in interviews, United States, July 1957-June 1958. *PHS Publication No. 584-B13; 1960; 36 pages; 30 cents.*

Data on heart conditions and high blood pressure as reported in household interviews are presented in 14 detailed tables and 9 charts showing these chronic conditions by age, sex,

medical attention, and the associated days of restricted activity and bed disability.

The text includes a discussion of the differences in prevalence estimates obtained through different survey techniques.

Dental care. Interval and frequency of visits, United States, July 1957-June 1959. *PHS Publication No. 584-B14; 1960; 42 pages; 35 cents.*

This report amplifies previously published National Health Survey data on dental care.

It presents 14 detailed tables on the interval since last dental visit by age, according to sex, urban-rural residence, region of the country, race, family income, and education. A second group of 14 tables relates the same variables to frequency of dental visits.

Dental care. Volume of visits, United States, July 1957-June 1959. *PHS Publication No. 584-B15; 1960; 45 pages; 35 cents.*

Amplifying National Health Survey data presented earlier, this report contains nine tables showing volume of dental visits by urban-rural residence, region of the country, race, sex, and age, and by family income, education, and age.

In another 14 tables, the same variables are related to type of dental service—fillings, extractions, cleaning or examination, straightening, gum treatment, and denture work.

This report also carries population tables.

Veterans. Health and medical care, United States, July 1957-June 1958. *PHS Publication No. 584-C2; 1960; 52 pages; 40 cents.*

A major section is devoted to selected health characteristics of veterans and nonveterans and the extent to which these two groups use the services of physicians and hospitals. It includes 12 detailed tables and a number of charts.

This is followed by a section on

veterans classified in three war groups: the Korean conflict, World War II, and World War I combined with the Spanish-American War. Thirteen detailed tables are presented.

A study of special purpose medical-history techniques. *PHS Publication No. 584-D1; 1960; 27 pages; 30 cents.*

A methodological study preliminary to the development of a medical-history questionnaire and appropriate interviewing techniques for use in a health examination survey of adults is described under seven broad headings: the research problem, the developmental interviews, reliability of responses, comparison of interviews taken by nurses and nonmedical trained interviewers, effectiveness of the open interview, and effectiveness of the self-administered and the closed-interview procedures.

The research was conducted by the survey research center of the University of Michigan under contract with the U.S. National Health Survey. Charles F. Cannell, Ph.D., and Morris Axelrod, Ph.D., of the Institute for Social Research, directed the project and were responsible for the analysis and the report.

Appendices in these publications give technical notes on methods, sampling errors, definitions of terms, and the questionnaire used in the household interviewing.

International Classification of Diseases Adapted for Indexing of Hospital Records and Operation Classification. *PHS Publication No. 719; 1959; 264 pages; \$1.*

Based on experience in a number of hospitals, finer subdivisions have been made in the International Classification of Diseases to promote a more efficient classification system for indexing diagnostic information on hospital records. The system is designed to permit location of the maximum number of records with the review of the least number. Also included is a classification of operations for indexing surgical cases.

The adaptation is an outgrowth of a collaborative study conducted by

the American Hospital Association and co-sponsored by the American Association of Medical Record Librarians. This is related to a study of efficiency in hospital indexing using the International Statistical Classification and the Standard Nomenclature of Diseases.

Although it is suitable for preparing statistical tabulations from hospital records, the adaptation does not serve as a medical nomenclature. (No free sample copies are available on this publication.)

National Institute of Mental Health. *PHS Publication No. 20; revised 1960; 30 pages; 15 cents.*

The organization and function of the National Institute of Mental Health, focal point for the Federal Government's efforts in the field of mental health and mental illness, are described. This booklet covers the institute's research, training, community services, and other activities in considerable detail.

It contains sections on research investigations conducted by the National Institute of Mental Health, research grants, training grants, State and local mental health programs, mental health project grants, program development, and public education. A four-page section of references is provided.

Mongolism. Hope through research. *PHS Publication No. 790 (Health Information Series No. 94); 1960; folder; 5 cents, \$3 per 100.*

Research by French and British scientists on the cause and prevention of mongolism and the program at the Public Health Service's National Institutes of Health are described in this folder.

According to the most recent theory reported in the pamphlet, mongolism may be triggered before pregnancy. In 1959 French investigators found in mongoloids studied, 47 chromosomes instead of the standard human 46. Chromosomes are the microscopic life threads within each cell which determine inherited characteristics, such as eye color and height.

To some researchers this new finding suggests that mongolism could

begin with an irregularity in the human egg before it is fertilized. They believe the discovery of the extra chromosome is a significant advance in the total search for the reason for mongolism.

The booklet mentions statistics showing that mongoloid children are born more frequently to older mothers than to younger women. About 1 mongoloid per 1,000 births is born to mothers under 30 years old. The rate rises with increasing age of mothers, to reach 2 to 3 per 100 births in women over 45 years old.

Housing and Health. *PHS Publication No. 718 (Public Health Bibliography Series No. 29); 1959; 27 pages; 15 cents.*

Intended for individuals working in and interested in the housing-health field, this publication is a compact, but comprehensive, collection of brief abstracts of 53 reports and studies made over the past 20 years.

It is designed to stimulate further interest in the housing-health field as well as strengthen the relationship of these fields. The information in the abstracts is sufficiently detailed for the reader to determine whether he wants to consult the original paper.

Are You Related to a Diabetic? *PHS Publication No. 726; 1960; 4 pages; 5 cents.*

This leaflet is designed for use by State and local health departments, voluntary organizations, and community groups in promoting case-finding activities among relatives of diabetic patients.

It briefly describes diabetes as a disease and the groups among the population most likely to be affected. The importance of early detection and treatment in preventing complications and reducing disability from diabetes is stressed.

Accident Prevention. A handbook for public health nurses. *PHS Publication No. 670; 1959; 55 pages; 25 cents.*

Accidents as a public health problem are described in relation to the philosophy of safety, their epi-

demology, and the human factors involved. Special attention is given to accidental poisonings and poison control centers, burns due to fires, carbon monoxide poisoning, lead poisoning in children, motor vehicle safety, childhood accidents, and those of the aging.

The role of the public health nurse in homes, schools, conferences and clinics, and civic groups is discussed, and 14 specific actions which will enhance her work in accident prevention are given.

Tables and charts of accidental deaths and injuries are presented by age groups and types of accidents. The booklet also contains a list of national agencies active in accident prevention and listings of films, books, pamphlets, and articles related to accident prevention.

National Water Quality Network. Statistical summary of selected data, October 1, 1957–September 30, 1958. *PHS Publication No. 663, supplement 1; 1959; 164 pages; \$1.*

A Federal, State, and local cooperative report on water quality determinations at selected locations throughout the United States, this supplement to the complete compilation of the data deals with selected segments of the information on radioactivity, organic chemicals, and plankton in surface waters.

While no interpretations are made, it is hoped that this publication will stimulate, among those concerned with water quality, the application of these data to current and future problems in water quality management.

An Industrial Waste Guide to the Cane Sugar Industry. *PHS Publication No. 691; 1959; 19 pages; 25 cents.*

The sixth of a series of industrial waste guides, this booklet summarizes available information on the nature, types, and amounts of wastes produced by the cane sugar industry. It also reviews methods that have been developed and used to overcome or minimize the harmful effects of waste effluents.

This guide was prepared in cooperation with the National Tech-

nical Task Committee on Industrial Wastes. It is intended primarily to assist the operators and managers of sugarcane processing plants to use, reduce, and otherwise suitably dispose of their waste waters. It is also designed to inform personnel of regulatory agencies of the sources and polluttional characteristics of sugarcane wastes and the status of developments in waste treatment.

Septic Tank Care. *PHS Publication No. 73 (Health Information Series No. 96); revised 1960; folder; 5 cents, \$2.50 per 100.* Written in nontechnical language for the individual homeowner. Discusses proper care and maintenance of septic tank sewage disposal systems and describes their functions and factors affecting them. Gives advice on how to avoid trouble and expense by inspecting the septic tank at regular intervals and determining when cleaning is needed. Encourages householder to provide himself with a diagram of his septic tank system. Back of pamphlet designed so that diagram and record of inspections can be kept there.

Enterobacteriaceae. Biochemical methods for group differentiation. *PHS Publication No. 734; 1960; by W. H. Ewing; 30 pages; 20 cents.*

This handbook was designed to be a practical guide for use by any laboratory, whether large or small, that does enteric bacteriological work. In it the author brings together, probably for the first time under a single cover, all of the tests found valuable in the classification of enteric bacteria.

Details to guide performance of each of the tests include materials and equipment required, procedures to follow, and interpretation of test results.

Selected Articles on Nursing Homes. *PHS Publication No. 732; 1960; 282 pages; \$1.50.*

Reprints of 47 articles and speeches deal with current problems facing nursing homes. The articles cover such subjects as nursing and related medical services, food services,

administrative management, and standards relating to the improvement of patient care in nursing homes. An appendix contains a directory of licensure agencies responsible for licensing nursing homes in the several States and list of selected special references.

This anthology was prepared to answer a growing need for reference material dealing with nursing homes.

Protect Your Family Through Immunization. *PHS Publication No. 697; 1959; folder; 5 cents, \$2 per 100.*

An immunization schedule for DPT (diphtheria, pertussis, and tetanus), poliomyelitis, smallpox, and boosters for all these, including individual tetanus boosters, is contained in this leaflet. The schedule is divided into three sections: first year of life, one year to entering school, and after age six.

Developed as a joint project of the American Academy of General Practice and the Public Health Service, this folder is intended to be given to patients by private physicians or health departments to provide a permanent immunization record for all members of the family.

Tuberculosis Chart Series, 1960 Edition. *PHS Publication No. 639; 1960; 28 pages; 25 cents.*

Nine charts and accompanying tables deal with the size and characteristics of the tuberculosis problem in the United States.

The introductory section discusses some of the highlights of the data. This edition focuses attention on the geographic variation of tuberculosis, mostly by States but with special attention to large cities.

Index Medicus (formerly Current List of Medical Literature). *Vol. 1, No. 1; January 1960; 274 pages; single copies \$2.25, \$20 per year (\$25 foreign).*

A monthly index to the world periodical literature of medicine, the new *Index Medicus* supersedes both the *Current List of Medical Literature* of the National Library of

Medicine and the *Quarterly Cumulative Index Medicus* which was published by the American Medical Association.

The initial issue contains a list of 71 subheadings, an abbreviation listing of the indexed journals, subject and author sections, and a list of recent United States publications. Information on the loan policy, instructions to borrowers, and a statement on outstanding coupons for photographic services are inside the front cover.

Free sample copies are not available. All communications regarding subscriptions should be addressed to the Superintendent of Documents.

What Consumers Should Know About Food Additives. *FDA Leaflet No. 10; 1959; 12 pages; 15 cents.*

This booklet answers the many questions the public is asking the Food and Drug Administration about the Food Additives Amendment to the Federal Food, Drug, and Cosmetic Act. It tells the story of how food additives came to be developed, why and how they are used in food production, why public health safeguards are necessary, and how the new law works. It also gives factual information about the functions of many of the more important classes of food additives, and explains how the law controls two special classes of additives, pesticides and coal-tar colors.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.

ECHOES

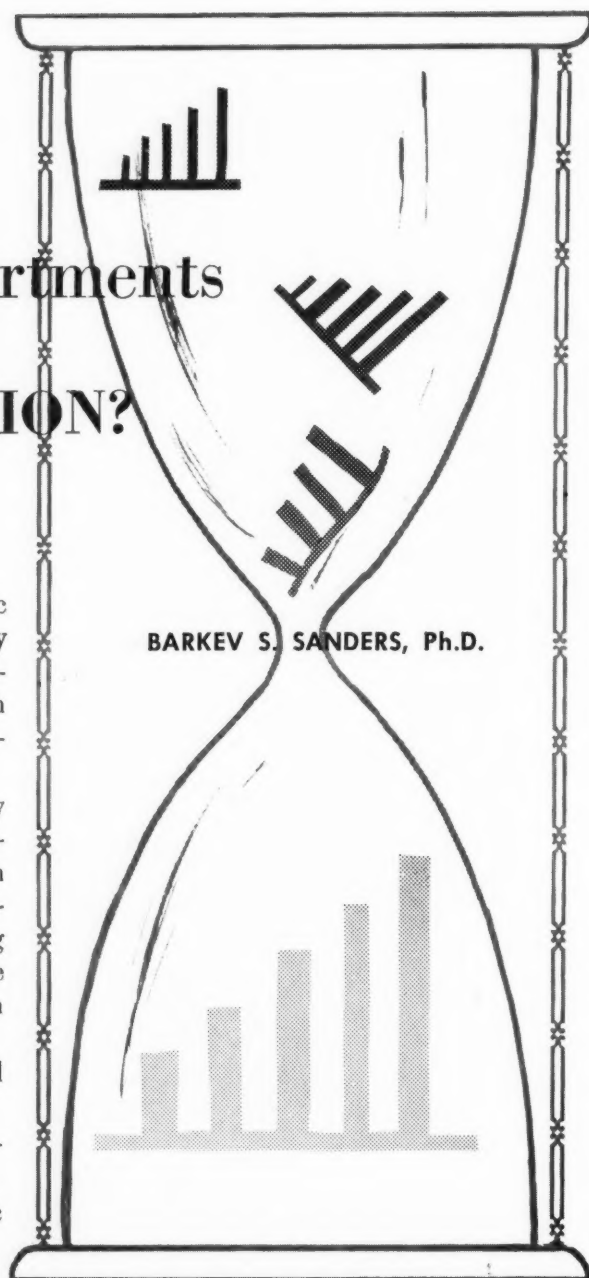
Local Health Departments GROWTH or ILLUSION?

STUDENTS of public health as well as civic leaders have begun to scrutinize the efficacy of the traditional pattern of local health departments (1-3). A critical look at the growth of these departments in recent years is therefore timely.

The growth of local health departments may be measured in several ways, each way possibly leading to a different conclusion. When independent approaches lead to common conclusions, however, we are justified in having greater confidence in the findings. We have chosen three methods of measuring the growth of local health departments in recent years:

- Extent of geographic areas covered by local health departments.
- Annual expenditures of local health departments.
- Number and skills of full-time local public health personnel.

BARKEV S. SANDERS, Ph.D.



JANUARY 1959,
pp. 13-20

Dr. Barkev Sanders concluded there had been no growth in local health departments between 1950 and 1957, after an analysis of geographic expansion, annual expenditures, and number of full-time health department employees. He raised the questions of whether other agencies were supplying certain needed health services, whether American communities were less interested in health than formerly, or whether the health needs that local health departments can deal with effectively had diminished.

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